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A System for Measuring Tapers

Designed for cartridge and gun chamber gages but equally applicable to other gages

CHECKING tapers that must be finished to a high degree of accuracy has always been a difficult problem to the gagemaker. This is rendered even more difficult where the original measuring points of the piece have been destroyed by rounding of the corners, as is frequently the case. In the chambering of rifle barrels there are three tapers that must be finished with extreme accuracy, and during the war period it was acknowledged that the checking of chamber specifications to bring about uniformity in the barrels, as made by the several manufacturers and government arsenals, offered one of the almost insurmountable difficulties in the way of the high production demanded.

After a long period of investigation and experimentation, a system for taper gage checking and measuring was worked out by the Winchester Repeating Arms Company, and adopted by the manufacturers who are members of the Sporting Arms and Ammunition Manufacturers Institute. This method of gage measurement, which will be described here, was proved out for the testing of gages for the rifle barrel chamber, but it is also applicable to any taper gaging where accuracy is a prime consideration. In Fig. 1 is shown a cross-section of a 30-caliber service cartridge shell. The requirements of great accuracy in the cartridge and in the barrel chamber are readily apparent when the tremendous explosive force of the charge is considered. The wall of the cartridge is thin, and the fit must be close enough so that there will be no bulging or rupturing. Tool marks in the chamber must me eliminated to such an extent that there will be no sticking of the metal of the cartridge in the chamber. The ideal condition is to have the accuracy of the chamber such that the force of the explosion will be taken on the shoulder angle *A*, and at the breeching surface.

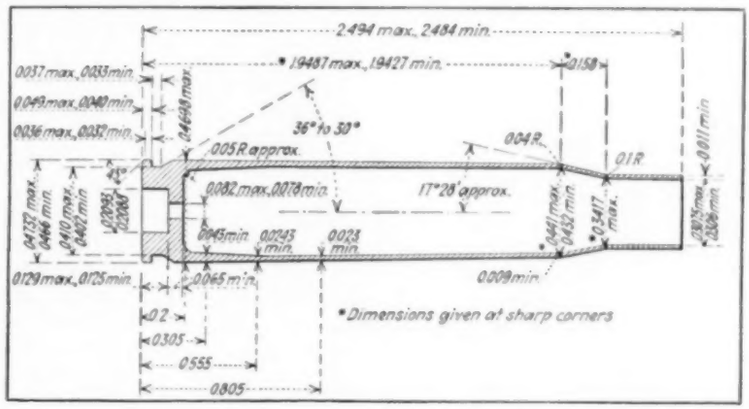


Fig. 1—Government drawing of a rifle cartridge shell, showing method of dimensioning to insure the great accuracy necessary for the proper functioning of the gun.

The gaging of the barrel breech during the process of manufacture is done by the gage shown in Fig. 3. It will be noted that the intersecting points of the body taper and shoulder angle have been removed by a radius connecting the body taper and a fillet connecting the neck taper, so there is no satisfactory method by which the inspectors can check the finished gage using dimensions shown on the Government print. Moreover, it is very difficult for the gagemaker to measure the corner *E* with any degree of accuracy, and almost impossible to measure the filleted corner *I*. During the war, when several factories in different parts of the country were endeavoring to make interchangeable rifles, this gaging problem was the cause of long delays in production, and practically the only method of comparison was by means of open cylinder gages and casts taken from chambers. When it is considered that a variation of 0.0001 in. in the diameter on the taper *H*, Fig. 4, makes a length variation of 0.0062 in., and on taper *K*, a variation of 0.020 in., which variation on *H* causes a longitudinal movement of gage equal to 0.0062 in., and in the case of taper *K*, 0.020 in., it can be seen readily that this method was very inaccurate and caused considerable trouble in interchangeability between master, inspection, and manufacturing gages. It was the belief of the engineers of the Winchester Repeating Arms Company that the gagemaker should be furnished with definite dimension measurements that would not be eliminated in the finishing of the gage and would be further available for check after the gage is in service. Dimensions were therefore established, as shown in Fig. 3, at definite diameter points between points of intersection on the shoulder angle, and at definite distances away from the intersecting points on the body and neck tapers. These dimensions were worked out mathematically from the theoretical dimensions as

given on the government master gage specification drawing shown in Fig. 3, corresponding to the dimension requirements of the cartridge shown in Fig. 1. Where the work is done from a government master gage, instead of from a gage drawing, as sometimes occurs, the problem is the same. It is assumed, however, that a master gage is nothing more than a mechanical specification. It is not a starting point, and an original drawing of the part required is the ultimate standard. This fact is especially important in government work where many different manufacturers must interpret accurately what is wanted.

Having set definite gaging points, a series of sectional cylinder gages were made showing diameters and lengths for measuring the points shown in Fig. 2. It was found that these sectional cylinder gages gave the gagemaker and inspector something very definite to work to, and to check against after the gage was made. With this method of sectional gaging, the separate gages could be compared with each other rapidly without destroying a fixed set-up, so that extreme accuracy could be maintained between the gages used by different companies engaged in the same work.

In order to check further the accuracy of the method, two gagemakers in different departments were given the job of making separate sets of sectional and full plug gages (shown in Fig. 2) to determine whether or not it was practical to duplicate a set of gages from the original dimension figures. Two full plug gages were later made by separate gagemakers working to two different sets of sectional gages. Upon completion there was found to be practically no difference in the two gages produced. Only on one taper was a perceptible difference found, it being on neck taper *I*, Fig. 2, amounting to a longitudinal distance of 0.002 in., equal on diameter to an 0.000010 in. error, which could be accounted for as the human error of the gagemaker. The sectional gage method was finally approved by the Sporting Arms and Ammunition Manufacturers Institute, and 14 pressure barrels were made by the Winchester company for the member manufacturers of the Institute, for ballistic testing of the 12-gage shotgun shells. The manufacturing and inspection gages were made from a set of sectional gages produced under the Winchester standard gaging system, and the maximum error found in the 14 barrels did not exceed ±0.0001 in. Previous to the use of this method, it had not been possible to obtain consistent uniformity between the test barrels used by the different companies so that accuracy of ballistic results could be assured.

The sectional gage system now adopted as standard by the Winchester company, and by the members of the

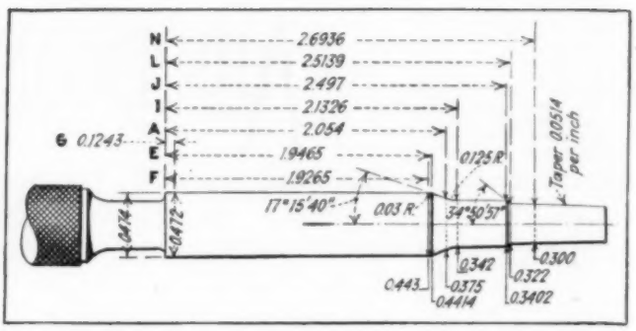


Fig. 2—Winchester method of dimensioning the gage which is employed for gaging the rifle barrel breach to receive the cartridge. Note that the dimensions are from definite points which will be left on the gage after completion

Institute, depends upon checks made from definite points on the gage back to the rear, or breech end of the gage. The accuracy required on these dimensions in the case of the barrel chamber gage has made the latter an ideal field for testing out the method, and the system of sectional gages similar to those which will now be described can be employed for any taper gaging where accuracy is required.

The set of sectional gages illustrated in Figs. 5, 7, and 8, is used for measuring the dimensions given on Fig. 2, which as previously explained, are deduced mathematically from the theoretical intersecting points of the tapers on the government drawing, Fig. 3. For checking dimension *A*, Fig. 4, the sectional gage, or diameter ring, 1, show at *A*, Fig. 5, is set on the surface plate. The hole in the gage has been ground and lapped for about ½ in. of its upper length to the exact diameter of the chosen diameter point, which in this case is 0.375 in. In the testing of gages the lower section is the only one in which wear comes, and as the height of this section is of no importance it can be ground and lapped true, and a sharp edge maintained at all times on the upper face. The gage 2 is for the length, or distance from the predetermined point to the rear end of the gage. The sleeve *S* is simply for aligning the sectional gages and holding them in place. When the plug gage is placed in position in the sectional gages so that the diameter point 0.375 in., rests on the sharp edge in the hole in the lower sectional gage, the rear end of the gage will be flush with the upper surface of the sectional gage 2, as shown in the illustration. It has been found on actual production work on other gaging that even the average production inspector can judge the accuracy within 0.001 in. when reading a flush gage of this character. The height of the sectional gage 2 is important, and its accuracy is tested by comparison with standard Johannson gage blocks using a fluid gage with a 3,000 to 1 multiplier for checking measurements. The standard blocks used are listed in Fig. 4, on the line corresponding to *A*. Having thus determined the accuracy of a definite midway point on the shoulder angle *A*, the next testing operation is to check the accuracy of this shoulder angle, designated as *B* on the gage drawing, and on the operation sheet in Fig. 4. This checking is

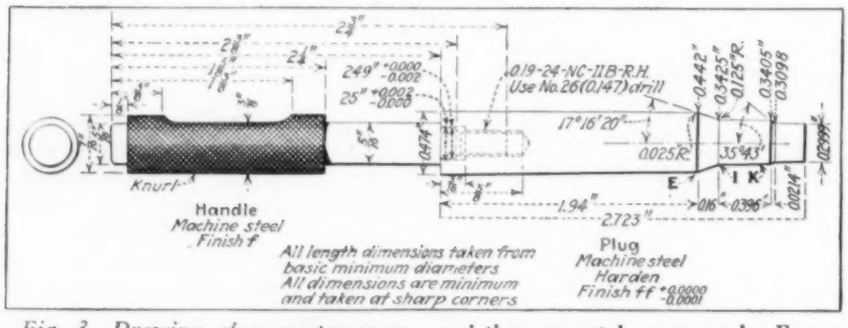


Fig. 3—Drawing of a master gage as furnished by the Government. The dimensions are taken from points that are destroyed in the grinding, and they cannot be measured. Even if the corners were left sharp, the required accuracy could not be obtained readily with ordinary gages

	Diameter	Length	Blocks	Total Height
A	0.375	2.054	1.00, 0.950, 0.104	2.054
B	Angle	1.950	1.00, 0.850, 0.100	1.950
C	Angle	First shoulder	1.00, 0.400, 0.122	Sine bar
D	Radius	2.2326	2.00, 0.132, 1.006	2.2326
E	0.4414	0.9465	1.00, 0.700, 0.146, 0.1005	1.9465
F	0.443	1.9265	1.00, 0.700, 0.126 0.1005	1.9265
G	0.472	0.1243	For base use ring 1	
H	Taper	Body	0.0062=0.0001 on diam. 0.200-0.1008 0.120-0.1004	0.0804
I	0.342	2.1326	1.00, 0.900, 0.132, 0.1006	2.1326
J	0.3402	2.497	2.00 0.350 0.147	2.497
K	Taper	Neck	0.020=0.0001 on diam. 0.3246-0.300	0.0246
L	0.322	2.5139	2.00, 0.300, 0.113, 0.1009	2.5139
M	Angle	Second shoulder	2.00, 0.150 0.140	Sine bar
N	0.300	2.6936	2.00, 0.450, 0.143, 0.1006	2.6936
O	Taper	Ball seat	0.0019=0.0001 on diam. 0.150-0.107	

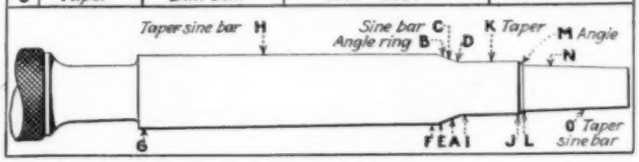


Fig. 4—Key chart used for showing the sequence of operations in checking the chamber plug gage shown in Fig. 2. It also gives the combinations of Johansson size blocks used in conjunction with the sine bar for obtaining angle measurements and various heights as designated on the gage drawing shown in Fig. 2

done with the sectional gage, shown at *B*, Fig. 5. In this operation the angle ring, 3, is set on a surface plate, with the sectional gage 5 for length on top. The chamber plug shoulder rests on the angle ring, and the end of the plug should be flush with the face of the length sectional gage 4. There are slots cut in the sleeve so that the inspector can sight through and view the angle on piece 3 for testing the accuracy of the angle on the plug. Sectional gage 4, placed on top of sectional gage 3, is the means of determining the length of the full plug from the shoulder to the rear end.

The next operation is the re-checking of the shoulder angle *C*, which is done with the sine bar, as illustrated in Fig. 6. The Johansson blocks used for raising the sine bar to the correct angle are given in the table, Fig. 4. The angle of the chamber plug gage on the bar is then tested with a dial gage on the surface plate.

The checking of radius *D*, Fig. 4, is now done with the set-up of blocks shown at *D*, Fig. 5. The two rolls 7, which are ground and lapped to the exact radius of the gage fillet *D*, Fig. 7, are placed as shown on the sectional gage 5, within the locating side pieces 6, and then with the sectional gage 8 on top, the whole assembly is placed within the sleeve ring *S*. In this case the hole in the sectional gage 8 is ground at the top to the exact diameter of chamber plug +0.002 in., so that the chamber plug will rest on rolls 7. The inspector then sights through the two slots in the sleeve *S*, to check the correct position and radius of the fillet. The exact measurement from the rear end to the corner *E*, Fig. 3, is now checked with the set-up of sectional gage shown at *E*, Fig. 7. It will be noted that the dimension 1.94, given on the government specification drawing, Fig. 3, is theoretical, and cannot be checked on the gage after the radius has been made. The dimension 1.9465 in., used on these blocks, is to a calculated point on the correct radius. In using the sectional gage 9, the plug gage is placed to rest on its edge in the hole in the sectional gage, which is ground and lapped to the exact diameter of the predetermined bearing point on the radius. The end of the chamber plug will then show flush at the top of the sectional gage 10 if the radius is correct. The checking of the body taper on the gage is now done with the sectional gage set-ups shown at *F* and *G*, Fig. 7. The point *F*, Fig. 4, is taken on the taper, 0.020 in. in the rear of dimension *E* on the radius. The chamber plug is placed on the base sectional gage 11, resting on the predetermined diameter. The end of the gage will read flush with the top face of the sectional gage 12, if the diameter is correct. The Johansson blocks used for checking the correct length of the sectional gages are given in the table in Fig. 4. The diameter *G*, Fig. 4, is next checked. This diameter is predetermined 0.002 in. less than the rear end diameter of the gage, and is found mathematically to be 0.1243 in. from the rear end of the gage. In checking, the chamber plug rests in the sectional gage 13, the diameter of hole in which is predetermined. The hole in ring 15 is 0.002 in. over size, and is free on the chamber plug. This height sectional gage is flush with the end of the chamber plug if the predetermined point on the taper is of the correct diameter. Having thus checked two points on the long taper, the latter is determined to be correct, but it is also

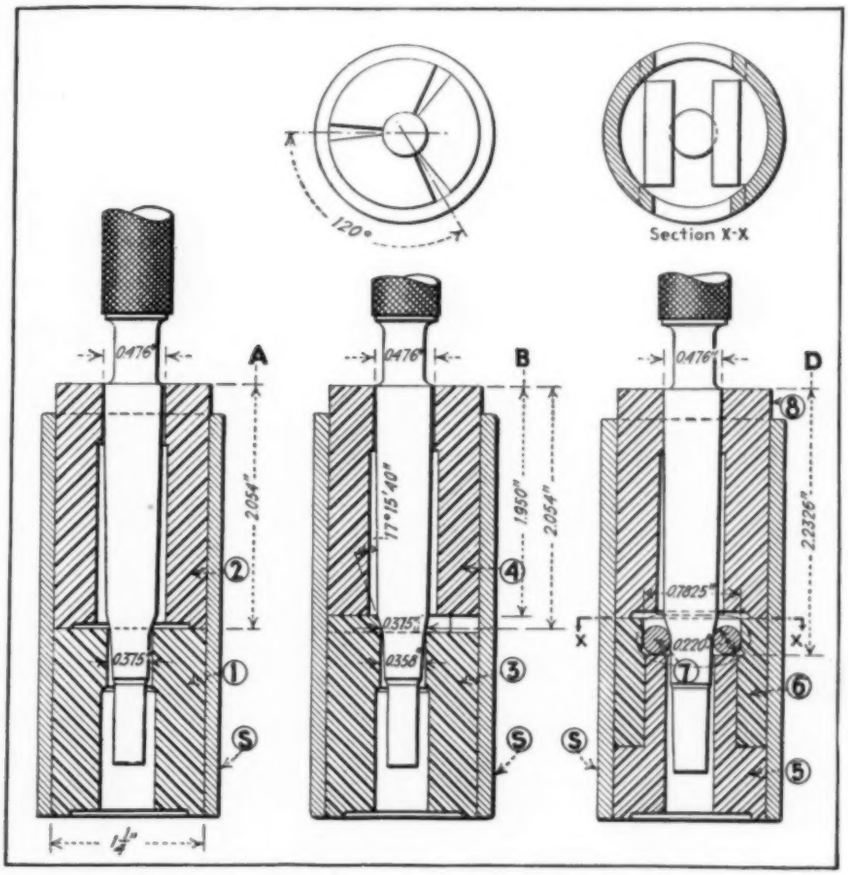


Fig. 5—Cylinder gages used for testing the breach plug gage. Set A *is employed for measuring a point on the shoulder angle,* B *for sighting the shoulder angle, and* D *for checking the radius of the meeting tapers*

rechecked for angle by means of a sine bar set-up in the same manner as that shown in Fig. 6, for the shoulder taper. The Johansson blocks used for setting the sine bar are given in the table, Fig. 4.

The neck taper is measured in exactly the same way as the body taper, by the use of the set-ups shown at *I* and *J*, Fig. 8. The taper is also checked by the use of a sine bar with the blocks given at *K* in the table in Fig. 4. The short shoulder taper, or angle *M*, Fig. 4, is checked by predetermining a diameter at point *L*, on the angle, and by using the sectional gage shown at *L*, Fig. 8, for checking. The angle is then verified with the sine bar set-up shown in Fig. 9, using the Johansson blocks designated in the table, Fig. 4, on the preceding page for setting up. The checking of the taper of the cartridge ball seat *N*, Fig. 4, is done from a predetermined diameter point with the sectional gage shown at *N*, Fig. 8. The angle is then checked with the sine bar, using the Johansson blocks designated at *O*, Fig. 4. This completes the checking of tapers and angles on the chamber plug. A supplementary gage for checking the profile is illustrated in Fig. 10, the sizes being determined by this system of measuring. This profile gage is provided with a set of flush gages for checking it. It can be readily seen that this method of checking tapers and angles is applicable to the measuring of accurate tapers or angles on any kind of work. The severe requirements of close tolerances in gun work, and the combination of accurate tapers and angles in the barrel breech have proved the method as practical from the standpoint of the gagemaker. It rests on the basis that the man in the shop who makes the gage, and the user of

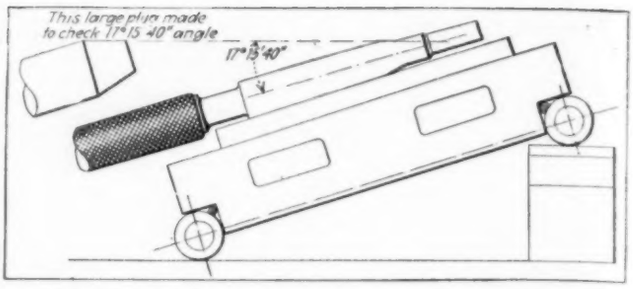


Fig. 6—Sine bar set-up for rechecking the shoulder angle on the plug gage

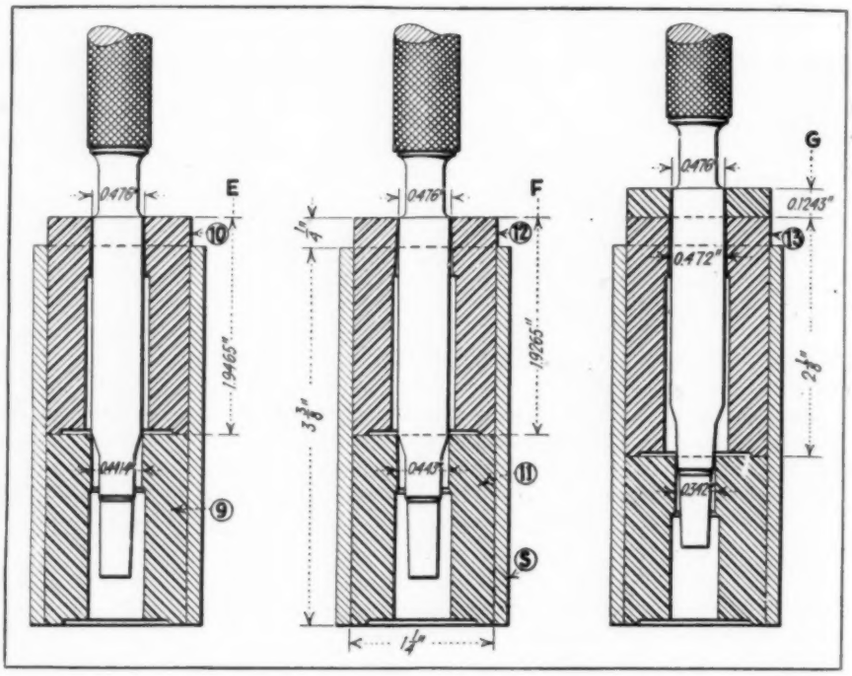


Fig. 7—The set of cylinder gages shown at E *is for measuring from the rear end of the plug gage to a calculated point on the radius. The set of gages,* F, *is used to check a predetermined diameter on the body taper of the plug gage. The set at* G *is for checking diameter* G, *Fig. 4.*

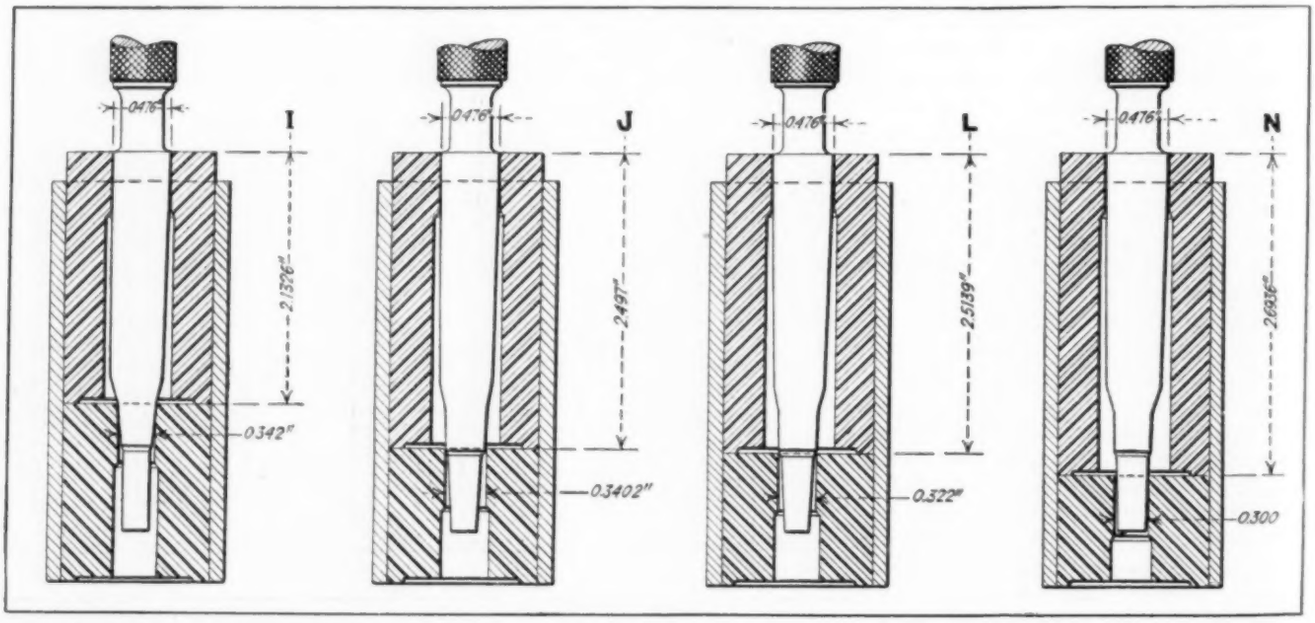


Fig. 8—The sets of blocks at I *and* J *are used for measuring the neck taper. The short shoulder taper is checked by the set-up of blocks shown at* L. *The checking of the taper of the cartridge ball seat,* N, *Fig. 4, is done with the set-up at* N

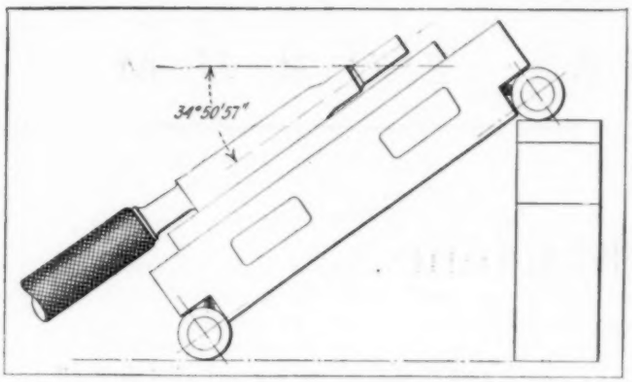


Fig. 9—Sine bar set-up for verifying the short shoulder taper on the plug gage

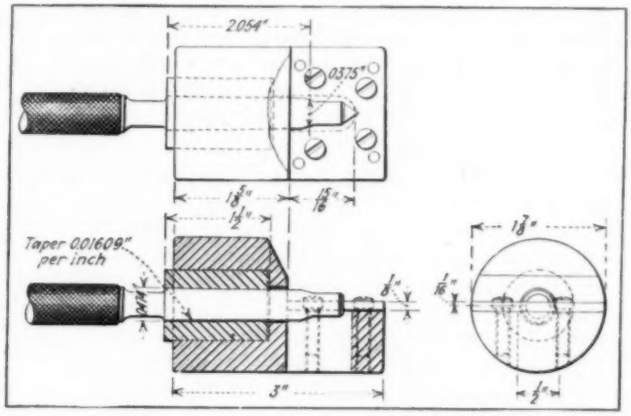


Fig. 10—Supplementary gage for final checking of the profile of the plug gage. This profile gage is provided with a set of flush gages for checking it

the gage, must be given definite dimensions to points that remain on the gage and are not destroyed by angles, tapers, radii or fillets. With such points established, the sectional gage method of checking, as described, can be used for any taper.

Building Bootleg Boring Mills

By John R. Godfrey

OLD Man Johnson has some unusual characteristics in his make-up. He can drive a close bargain, and he hates to be stung as badly as any man I know. But he has a pretty keen sense of proportion, or equity, or whatever it is that makes a man look beyond the present dollar and try to see where next year's dollar is coming from. His ultimatum to Bill Brown, and the boring mill proposition, shows how he feels about bootlegging in the machine business.

"But, Mr. Johnson," Bill was saying as I walked in. "I can save you a thousand dollars on that boring mill. I'll give you a machine that will do just as much work, do it just as well and you'll be a thousand dollars in pocket."

"Tell Godfrey, here, how you're going to do it, Bill," said the Old Man. "I want him to get the story first hand—he'll be interested."

"Well, you see, Mr. Godfrey," Bill went on, turning to me, "I don't have any development or engineering cost. The regular builder has to have a lot of draftsmen and keeps trying out new things. After he builds a good mill it's easy for me to duplicate it at less money. Then too, Mr. Godfrey, I don't have much overhead. I boss the shop, my sister keeps the books, and you see my overhead is very low."

"Bill," said Johnson, "if you weren't such a good-hearted and well-meaning bird, I'd call you a pirate. As it is you're just a boring-mill bootlegger, and you don't even know it. I suppose it's because copying machine design is so darn common that you don't see anything unethical about it. As long as the machine isn't patented and you can keep out of jail, you think it's O.K. And you're kidding yourself a lot about overhead, Bill. You think the shop has to run anyhow and you always charge the overhead to the other job, no matter what it is. I'll bet you didn't make enough money last year to buy any new machine equipment. How much of that profit, assuming there was some, did you tuck away in a depreciation fund, Bill?

"Why none, Mr. Johnson. But you see I'm only a job shop—"

"And you'll always be a job shop, Bill, if you keep on trying to get business by copying some one else and taking business below a fair price. It isn't reasonable, Bill, that you can build one or two boring mills a year as cheaply as a concern that specializes on that work. It can't be done, and the mill won't be as good anyhow."

"But I can save you a thousand dollars, Mr. Johnson. Isn't that worth while?"

"Bill, I can't afford to save a thousand dollars that way. I'd like the thousand all right to tuck away toward a new car that I want to buy next year, but I can't afford it."

"Don't see just what you mean, Mr. Johnson."

"Well, just suppose, Bill, that I'd bought nothing but copied machines for the last twenty years. Just suppose most of the other motor makers had done the same. What would have become of the men who build *real* machine tools? What would our motors cost us to build as compared with the present? The real builders of machines would have gone out of business and we wouldn't have any of the new machines you want to copy.

"I'd like to give you some work, Bill, but I can't afford to. You fellows who run job shops and try to horn in on the machine-tool game are all wrong. There isn't any too much market at best for the new high-production machines, and when you fellows try to switch a little of it here and there, it handicaps the whole industry.

"No manufacturer who uses machine equipment to turn out his product can afford to do anything that may prevent development of new and better machines. We've got to keep on getting better and better boring mills and such, and we'll never get 'em from those who only copy, even the best, that are on the market.

"You're in the wrong game, Bill. Stick to your job work—make special fixtures and dies and such if you want to. Or devise something that's really good in any line, and build it. But don't try to bootleg boring mills or anything else. It isn't because I have any special love for the particular fellows who build boring mills, but the whole future of industry depends on keeping them producing better machines for manufacturers to use. I know your game isn't contrary to any amendment, but it's bootlegging just the same and it will do nobody any good in the long run."

Finish on Machines

AMOS HARE, the banker who has become interested in several of the industries in town because of giving them bank accommodation, sometimes asks embarrassing questions. And, once in awhile, he misses a point, like the rest of us. This time he was questioning the amount of money spent for finishing a machine being built by the Hickey Grinder Works. And, as usual, Bill Holland was present, by invitation.

"It seems to me," began Hare, "that you spend too much money dolling up that pet grinder of yours, Hickey. It looks like a million dollars, I admit, but I don't believe it's all necessary. Do you, Bill?"

"I'd rather let Hickey tell his story first, Amos. And perhaps Trimble there has something to say also. He is the sales manager, and may have a new slant on the question."

"I felt a little as you do, Mr. Hare. We didn't doll those machines up, as you call it, nearly so much last year," spoke up Mr. Hickey.

"But didn't they do their job just as well, Hickey? That automobile finish doesn't affect the working part any, does it?"

"No and yes, Mr. Hare. No, because the machine would grind just as well if the frame wasn't even snagged. It would probably cost us more to handle it in the shop, but after we got it finished it would grind just as well without any paint at all—when it was new."

"I don't just get you, Hickey—what has the paint got to do with its grinding well when it was new?"

"Because, Mr. Hare, it would not give good service for as long a time. The men wouldn't take care of it. Of course they ought to—but they wouldn't. They never do."

"Sounds a bit fantastical to me, Bill. What do you think of that story?"

"I'm quite sure there's something to it, Amos. Men do not respect and care for tools that look rough and cheap."

"There's another angle too, Mr. Holland," said Trimble, the sales manager. "It's easier to sell a good looking machine. Customers may kick because you spend too much money on a fine paint job, but they pick the best finished machine just the same. They may talk about only being interested in 'what's under the hood' when they buy a car, but try to sell them a poor paint job on the best of cars and watch them shy off."

"But couldn't you sell at a lower price if you saved the extra money on the paint job?"

"Could you loan money at a lower rate, Mr. Hare, if you had plain wood counters in your bank instead of marble—or if you sat at a cheap, imitation oak desk instead of that rosewood one that's in your office?" spoke up Bill Holland.

"Your overhead might not be as high, but you know you wouldn't do the business you do now. People go where the fittings spell money and reliability. Sometimes they get fooled, just as they do with a fine looking machine or car. But try to sell 'em one that looks poor!

"I don't know just how much the extra filling and painting costs. But I'll bet it isn't half as much as the extra cost of selling a machine that looks second rate whether it is or not."

"It looks as though you had me on the run," chuckled the banker. "You sort of got under my guard when you dragged in the bank, Bill."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

Beware of Stratification

Fifteen years, spent on process planning and system simplification that has taken me from the thoroughly "stratified" shops of Great Britain and Continental Europe to the bewilderingly "conglomerate" ones of South America, has served to emphasize one phase of the question raised in the Executive Forum topic, on page

644, Vol. 69, of the *American Machinist*. This phase relates to the astonishing relation between the degree of "stratification" and the demand for new men. Almost without exception I have found that the shops having the most closely drawn caste lines were the ones compelled to rely upon outside sources for their new foremen, draftsmen, and executives; while those shops which had more of the spirit of "begin-at-the-bottom" never seemed to lack budding talent for any opening that might develop.

Surely, the provision of potential executives and future foremen is in itself sufficient justification for the abolition of any tendency toward forming caste groups. If, as we are told by experts, it takes six months to break in a new machine operator and bring him to the point where he is a money-making part of the organization, it should be worth the effort to gain the saving which accrues through promoting able men within the organization, men who are already familiar with processes and production, and whose mental attitude has kept them posted on the work of the man next in line.

Likewise, a check-up of plants wherein I have worked shows that a full seventy-five per cent of those needing the services of what was once glibly termed an "efficiency engineer" have been those with highly developed caste restrictions, a condition which was fruitful for the consultant, but expensive for the owners. That is, the new blood brought in to fill vacancies has not been of the progressive type which instinctively seeks to improve production conditions within the shop in which he is working.

Another mark of the "stratified" shop is the response to employee suggestion boxes. Classifying my clients first, as "stratified"; and second, "non-stratified"; and correlating data on suggestion boxes, I find the first class to have been only one-third as productive of response to the suggestion-box idea as was the second; and, what is of even more import, less than one-fourth as likely to act favorably on the suggestions offered.

Though my work, largely because of the conditions which I have cited, has been to a great extent among the "stratified" type of plants, observation and experience lead me to grade the average "stratified" plant at from three to five years behind the similarly-equipped plant in which class lines have been erased.

—ELTON STERRETT.

Planning the Plant Layout

This topic seems to come at an opportune time. The production at our plant has grown so that we are cramped for room and therefore are planning to enlarge our factory. We are working this in the following manner: The construction department is preparing plans showing the new area. This is to be divided into the following: Offices and engineering department, manufacturing department, assembly and painting department, and a shipping department.

After these plans are finished, prints are to be distributed to the heads of the departments interested. Each department is to fill in the plan in a manner that will entail least expense with greatest efficiency, and route the product so that material will flow in one line as far as is practical. Our aim is to have parts come from the machines into the inspection department and thence to the stockrooms, from the stockrooms into the assembly department, and from there to the shipping department. As we also handle a large quantity of parts made outside our plant, these parts must also be routed to co-ordinate with machined parts required for assembly.

After each department has submitted its plan, the whole is to go to the board for further discussion and refinement, as in the last analysis, it is dollars that will be required to effect the change.

—F. KLINGENSTEIN.

Paying for Special Designs

The most equitable solution to the problem brought up would be to pay the designer for the use of his design, basing the payment on a fair profit on the building of the machine. Not to pay for the use of the design would be taking advantage of common decency. It is advocated that the buyer take into consideration the designer's claim to a share of the profits on the building of the machine, and make arrangements with the builder, to adequately reimburse the designer for the use of his design.

—JOSEPH BELL.

Asking Quicker Deliveries than Are Needed

If the salesman of the Consolidated machine company had not reported the information concerning the machines lying idle for a month, would Mr. Austin have been indignant? Mr. Austin accepted the order at a price and a delivery date. He understood the conditions before doing so, and while the knowledge he has gained may be useful, it can be applied only to future orders. I think Mr. Austin would lose dignity by going to the president of Darrow's. The president would probably rub his hands and smile, but would not accept criticism. To start an educational campaign would not help much, as a customer objects to being educated. The best thing to do is to secure another order and try to make it balance the previous bad one. While Mr. Austin may have two kinds of quotations, he must gamble in using them.

—FRANZ BERMANN.

Metal Pontoon Construction

Photographs by courtesy of the Glenn L. Martin Company and the U. S. Navy

Fig. 1—Form for assembling and riveting the keel and deck-stringer assembly for the pontoon of a new Martin Navy airplane. The assembly methods resemble those used in wood construction. The forms are largely of wood

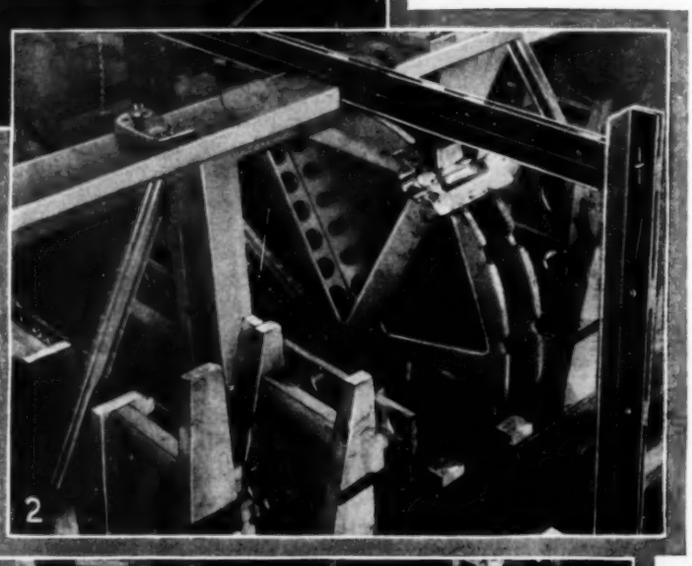


Fig. 2—Fixture for locating the casting for the front strut on the pontoon. The angle framework carries ears that locate castings by means of the hinge-pin holes that attach it to the strut. This casting is supported by the two bulkhead members shown, and after being located, is drilled and then riveted into position

Fig. 3—Another and heavier form for assembling the center-line bulkhead of the pontoon. A number of the cross-struts are shown in position, ready to be riveted to the T-shaped top member. The struts are Phoenix sections and can be easily attached

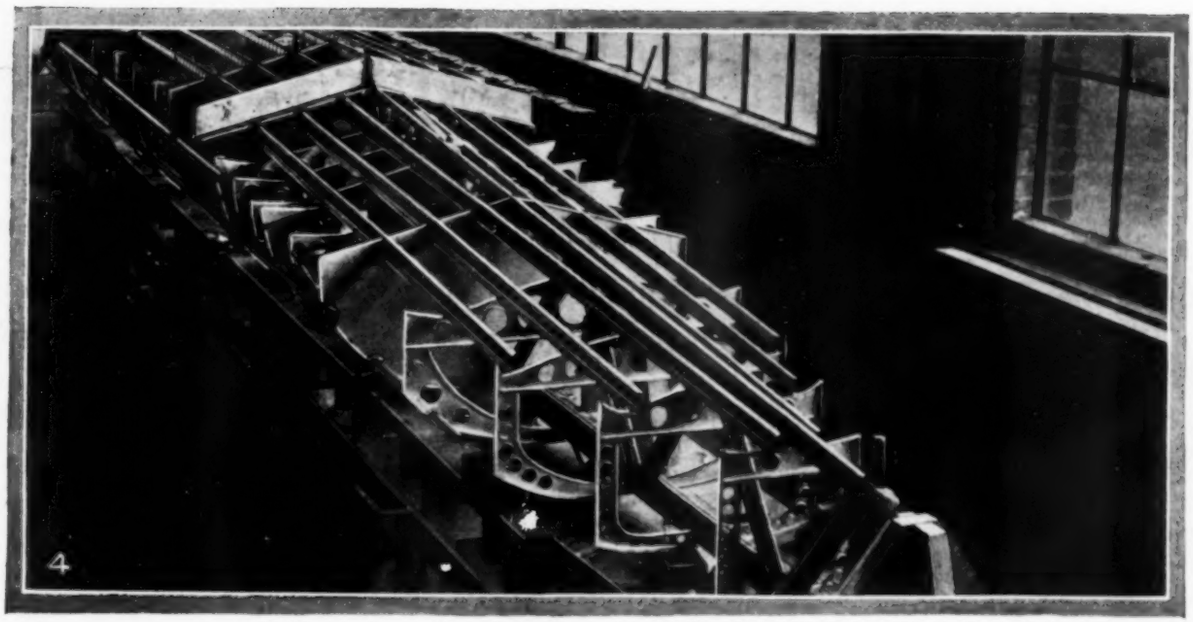
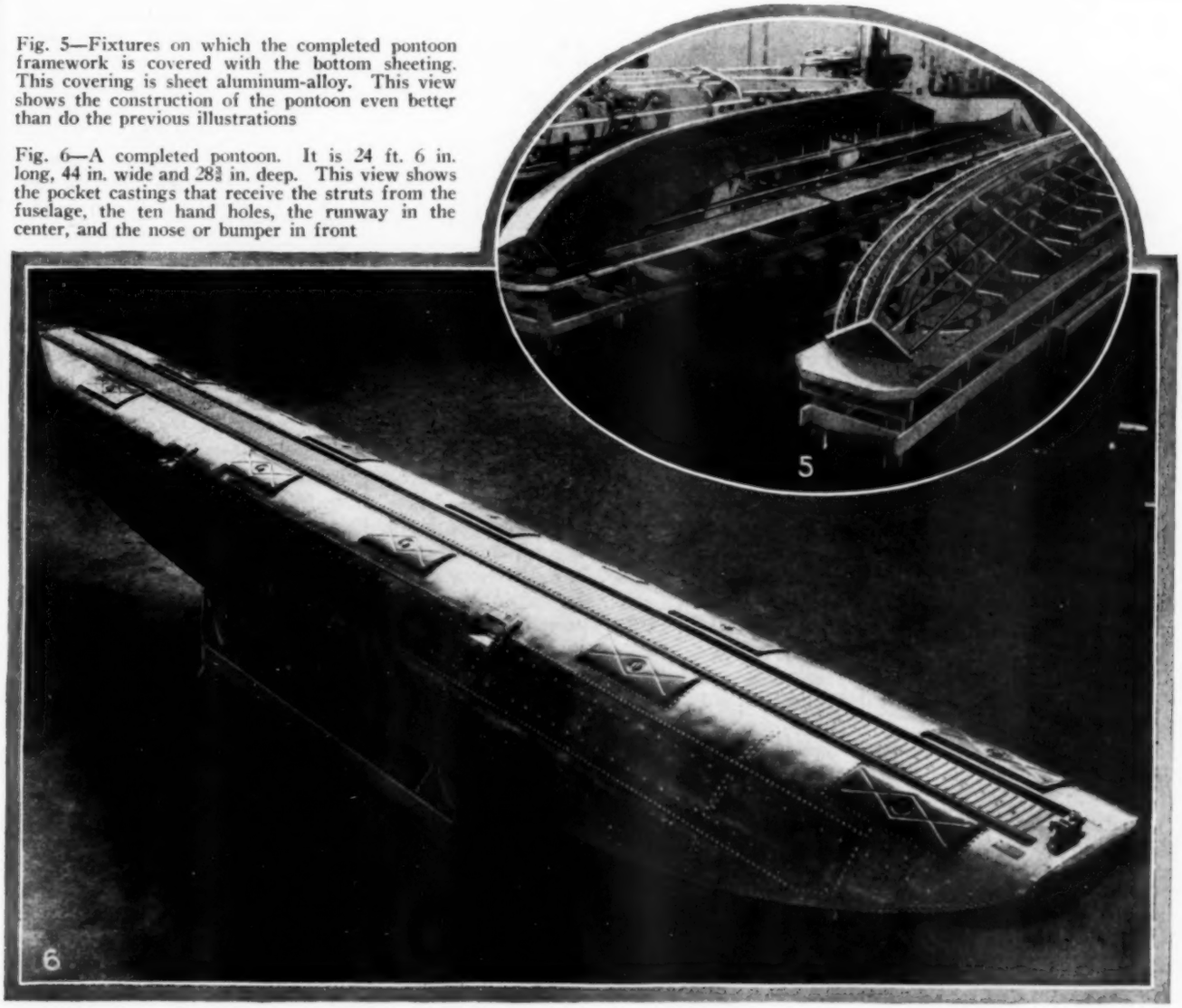


Fig. 4—The pontoon begins to assume its completed shape. The fixture holds the skeleton pontoon while the bottom stringers, steps and floors are put on. This view shows how the pontoon is constructed, how the bulkheads and cross-members are attached to the center line bulkhead, and the way in which various members are lightened by perforations

Fig. 5—Fixtures on which the completed pontoon framework is covered with the bottom sheeting. This covering is sheet aluminum-alloy. This view shows the construction of the pontoon even better than do the previous illustrations

Fig. 6—A completed pontoon. It is 24 ft. 6 in. long, 44 in. wide and 28¾ in. deep. This view shows the pocket castings that receive the struts from the fuselage, the ten hand holes, the runway in the center, and the nose or bumper in front



Principles of Jig and Fixture Practice

By Joseph W. Roe
Professor, Industrial Engineering, New York University

The principles governing the detail design are brought together, and a bibliography of publications recommended, which presents best practice in design and details

THE pressure due to the feed and rotation of the cutter should be against the solid part of the fixture as shown by Fig. 1, and not against the clamp. This principle is often violated, as the wrong way is usually more convenient. In general, the feed should be against the rotation of the cutter, not with it. This avoids a tendency to dig in. This has been good practice for many years. There is, however, some tendency away from this of late years. Locate the feed and cuts to throw the burrs for the various cuts on the same side, to reduce burring operations as far as possible. In order to be sure that burrs do not vitiate correct setting, in subsequent operations, it is wise to provide clearance grooves on locating surfaces so that burrs cannot interfere with correct setting.

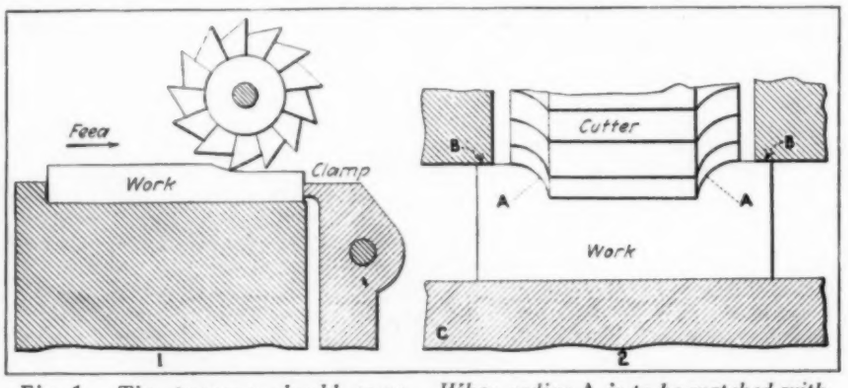


Fig. 1 — The pressure should come against the solid part of the fixture, and not against the clamp. Fig. 2— When radius A *is to be matched with surface* B, *locate from* B *and not from the supporting surface* C

LOCATING. Locating surfaces should be as small as is consistent with proper support and wear. The larger the surface, the more care and time is necessary to keep it clean and free from chips which destroy proper setting.

If a surface is to be matched in a milling operation, locate from *that* surface as at *B*, Fig. 2. It may be more convenient to locate from the opposite face, but locating from the matching surface, is correct and produces better work. A variation in the thickness of even a half of a thousandth will show, although it may not affect the operation of the piece.

Avoid sharp corners between locating surfaces, as shown by Fig. 3. They catch dust and dirt and are hard to clean.

The number of fixed supports should not be more than three. These should be as far apart as possible. If other supports are needed they should have only spring tension against the work during clamping and be locked in position after the work is set. For various forms of spring supports see references in Appendix No. 1, under "Plungers."

It should be easy to keep the locating surfaces clean. Therefore, there should be ample clearance for chips. If possible, accumulated chips should fall away from, rather than on to, the locating surfaces when the work is removed. If possible, keep the locating surfaces completely covered by the work, so that chips can not collect on them. All the locating surfaces of a jig or fixture should be fixed. Movable surfaces should be used for clamping only. Buttons or pins, hardened and ground, are often better for locating than flat surfaces, as they are easier to keep clean, and afford easier adjustment for wear. They are better as shown by Fig. 4, when acting endwise than sidewise, as there is no bending action, and they are more readily set up for wear. It is better to support castings on buttons or pins than on flat surfaces. They position better and more definitely. Surfaces which locate drop-forgings should have clearance for the flash, and preferably should be located from one side of the flash only, as the dies which made the forging may not have been exactly matched. Locating from the upper side of the forging, or that above the flash, is preferable.

The clamping should not produce any horizontal sliding action across the locating faces as this causes wear.

Locating and supporting points should, as illustrated by Fig. 5, be as far apart as the nature of the work will allow. The locating and supporting points should be visible and easily accessible to the operator.

Do not stack pieces one against another, if accuracy is required. In multiple work each piece should be located independently against fixed stops. In well-designed fixtures this is done, although several pieces may be clamped by one motion.

In multiple milling fixtures, do not mill the pieces serially, with a single cutter, if the runs are long. Use multiple cutters, one for each piece and feed across the row. This reduces the length of feed and therefore the cutting time.

Parts of the fixture requiring accurate location should be held, as shown by Fig. 6, by screws and dowels or splines. The screws should not have to perform the double function of locating and holding. When locating

Conclusion of a paper contributed by the Machine Shop Practice Division of the American Society of Mechanical Engineers, and presented at the annual meeting of the Society, Dec. 3 to 7, 1928.

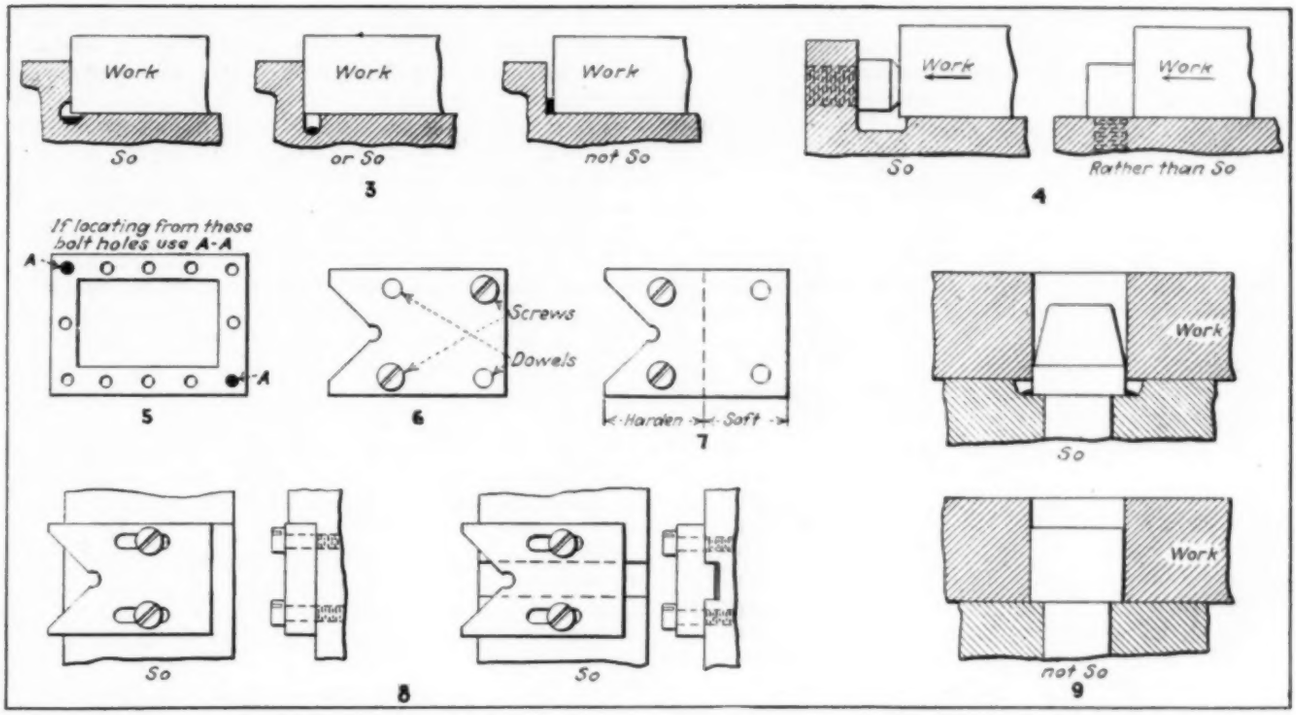


Fig. 3—Sharp corners are hard to clean. Figs. 4 and 5—Locating pins should be placed to avoid bending, and should be as far apart as possible. Fig. 6—Screws should not perform the double function of locating and holding. Fig. 7—The design shown allows reaming of the dowel holes in place after hardening the contact surface. Fig. 8—Methods of positioning locating blocks in one direction. Fig. 9—The tapered pin works faster

blocks are assembled into fixtures it is sometimes desirable to arrange the screws and dowels as shown in Fig. 7. When arranged this way, the contacting surface only is hardened, leaving the section carrying the dowel pins soft, so that the reaming of the holes and the alignment of the piece, can be done after hardening.

Where the positioning need be only in one direction, the side of the piece, or preferably a tongue and groove, may be used, as shown by Fig. 8, for locating, and the screws go through slotted holes.

If position pins are used for locating a previously drilled hole, that portion which is full diameter should be as short as is consistent with wear, and the rest or upper part of the pin tapering, as illustrated by Fig. 9. The tapered pin works faster and there is less likelihood of sticking.

Locating pins should be hardened and ground with clearance for burrs and chips. When used with counterbored holes they should center on only one diameter. When two pins are used for locating, one should be flattened, as shown at *A* in Fig. 10, on the sides toward and away from the other pin. Sometimes it is desirable to flatten both pins, as shown at *B* in Fig. 10, the plane of the flattening being at 90 degrees. If one pin, preferably the larger one, is higher than the other, the work can be seated more rapidly.

CLAMPING. Under no circumstances should the line of clamping pressure come above the stop. If it did there would be a tendency to lift the work. Side clamps should press downward as well as inward (See Fig. 1). By so doing the clamping tends to seat the work.

The clamp should be immediately opposite the supporting point, with solid metal between. Disregard of this, as illustrated by Fig. 11, leads to springing the work, or lifting of the work due to the support acting as a fulcrum. Clamps and adjusting points, (See Fig. 12) should be operated from the front or working side of the fixture.

The end thrust should be taken up by an adequate, fixed stop, not by the friction between the work and the clamp. Clamping jaws should, if possible, be at right angles to the direction of the cut, not parallel to it. All the clamping strain should be cared for within the fixture itself. None of it should be transmitted to the table of the machine.

Cams or wedges, if used for clamping, should be so designed that the pressure and feed tend to tighten them, not to loosen them.

Clamps should have springs and washers under them, as shown by Fig. 13, so that the operator will not have to hold them back while inserting the work. A better form, as shown by Fig. 14, has the spring concealed, so that chips can not interfere with it.

To save time in loading and unloading a fixture, clamps which have considerable motion should, in order to clear the work, have a rapid action when free from the work, and a slow motion with increased power when they are brought into contact with it. A variety of devices are available, such as the toggle-joint, bayonet screw, interrupted thread and slotted clamp.

Clamps holding castings and irregularly shaped surfaces should be on the floating principle, to enable them to adapt themselves to the shape of the work.

JIG LEGS. The center of gravity of the jig, with the work in it, and also the thrust of the drill, should lie within the geometrical figure formed by the supports. This avoids a tendency to lift or tip.

A drilling jig should have *four* legs. With a three-legged support, it will rest stable on any surface. If a chip is under one leg of a three-legged support the fact will not be detected. With a four-legged support the jig will teeter if it is on an uneven surface or a chip is under

one of the supports. Supporting strips or lugs are sometimes better than legs, as they are less likely to drop into T-slots or holes in the machine table.

JIG BUSHINGS. Loose or screwed-in solid bushings should not be used where accuracy is important. Where screwed-in bushings are necessary they should center on cylindrical surfaces, not on the threads.

The length of bearing for the drill should, in fixed bushings, be about one and one-half to two times the diameter of the drill; in slip bushings about two to three times the diameter of the drill. If the bushing is longer than this, the remainder of the length farthest from the work may be relieved.

Bushings should not be located close to the work with the object of carrying the chips up through the bushing except when the holes to be drilled are in a machined face which is clamped against a similar face in the jig. It is better, when the design will permit, to allow the chips to clear between the work and the bushing. About one drill diameter is usually sufficient. For small holes, where great accuracy is required, the bushing should be brought down close to the work. For drills smaller than No. 31, this dimension may be approximately $\frac{1}{64}$ in. with drills ground with a flat point.

JIG LATCHES. In the joint of a latch, give the latch the widest possible hold, as illustrated by Fig. 15, on the hinge pin. A still better type of latch which gives better side support when in working position is shown in Fig. 16. If possible, avoid placing clamps in a latch which carries drill bushings, as any clamping pressure has a tendency to spring the latch and throw the bushings out of alignment.

Preferably, a jig latch should have a support or stop to hold it when it is thrown back. This lessens the possibility of misalignment through use. It may be of advantage to have the hinge pin tapered. This permits readier adjustment for wear.

GENERAL. Thumb-nuts, fluted nuts, and levers should be used where the quantities are large, as the necessity of handling wrenches is thus avoided. They should be large enough to give the required pressure easily. When it becomes necessary for an operator to use a mallet, time is lost and either the work or the fixture is likely to be sprung.

Thumb nuts and hand knobs should have ample clearance around them to permit their being manipulated properly and to avoid possibility of injury. Avoid knurled nuts and handles. When covered with cutting lubricant they are irritating to the operator's hands under constant use.

If it is necessary to use a wrench in setting the work the various nuts should preferably be of the same size, so that change of wrenches is not necessary. All exposed screws, nuts, and lugs, the motion of which might catch the operator, are to be avoided, and all sharp corners and edges should be removed. The operator's hands

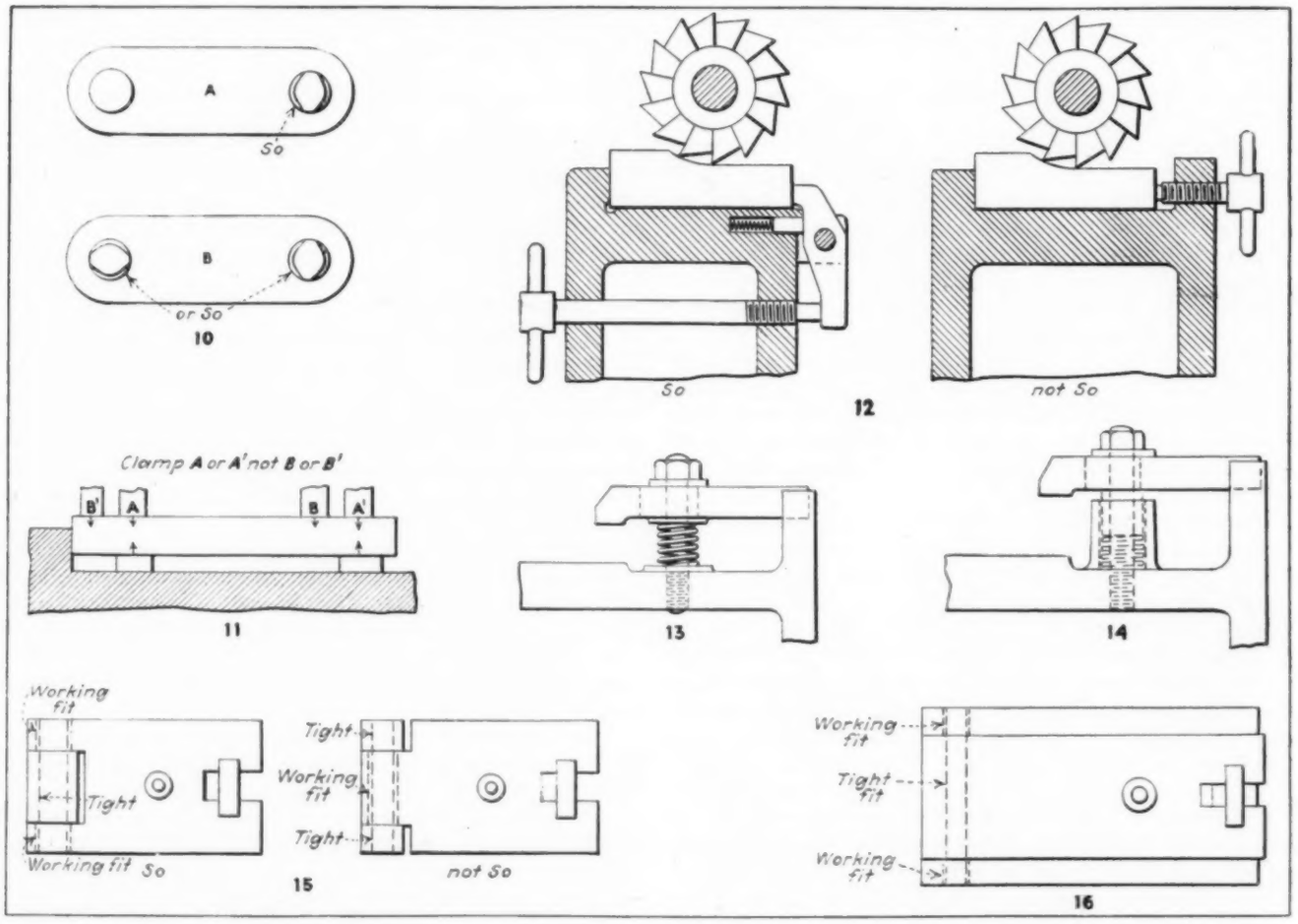


Fig. 10 — Flattening so that only one pin locates in a given direction assists in the rapid location of work. Fig. 11 —Clamps should be immediately opposite supporting points. Fig. 12— Clamps should be operated from the working side of the fixture. Fig. 13— The spring and washer holds the clamp while the operator is inserting the work, and the design of Fig. 14 has the additional advantage of being free from chip interference. Figs. 15 and 16 show how the latch can be given a wide hold on the hinge-pin and side support in position

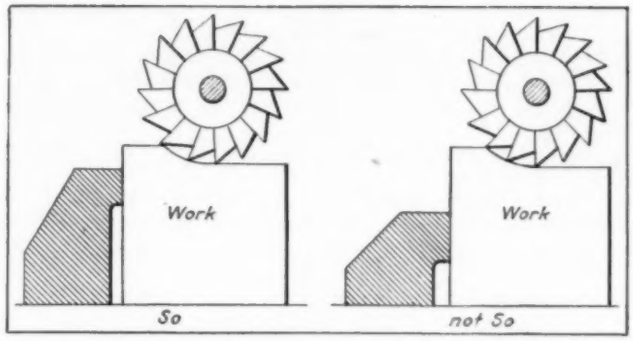


Fig. 17—The supporting surface should be as nearly in line with the cut as possible

must be well clear of the cutters during the insertion, clamping, and removal of the work.

There should be no danger of destruction of the work, tool, fixture, or machine through the over-running of the cutter.

It is desirable to have the cutting zone as close to the machine table as possible. If, for some good reason it must be high, then the surface taking the thrust of the cut should be high; i.e., as nearly in line with the cut as possible. In Fig. 17 this is illustrated.

It is desirable that parts subject to wear be renewable without destroying the jig or fixture.

Appendix No. 1—Subject Index to Bibliography

In the following index, the capital italic letters *A*, *B*, *C*, etc., refer to the references listed in the Bibliography, Appendix No. 2.

Assembling jigs, *C*, p. 97.

Automatic millers, fixtures for, *Machinery*, June, 1925, p. 772.

Boring jigs, *A*, Chap. VIII

Box jigs, *A*, Chap. III

Broaching fixtures, *C*, Chap. X

Bushings, *A*, Chap. IV; *C*, Chap. III; *D*, Chaps. IV and VI; *F*, Oct. 13, 1927, p. 565; *G*, No. 1, "Jigs and Fixtures;" *American Machinist* Handbook; *Machinery's* Handbook; standard lists of various manufacturers

Chips, influence of, *B*, Chap. XII; *C*, pp. 31 and 90

Cost of jigs and fixtures, estimating, *Machinery*, Feb., 1925, p. 427

Clamps, *A*, Chaps. VI and XI; *C*, Chaps. II, III and VI; *D*, Chap. VII; *E*, pp. 242-247; *F*, Mar. 8, 1928, p. 425, Mar. 22, 1928, p. 505; May 3, 1928, p. 733, May 10, 1928, p. 781; *G*, Nos. 7 and 7*a*, "Jigs and Fixtures"

Collars, *F*, Nov. 3, 1927, p. 695.

Continuous milling fixtures, *C*, Chap. VII; *E*, pp. 223 and 258; *D*, p. 117; *Machinery*, Jan., 1915, p. 350

Compressed-air fixtures, *Machinery*, Apr., 1927, p. 590; May, 1927, p. 673; July, 1927, p. 814; Aug., 1927, p. 894; Nov., 1927, p. 196

Details of jigs and fixtures, *Machinery*, June, 1916, p. 839 (Covers stop-pins, spring pins, hinge pins, draw pins, straps, latches, hook bolts, and swing bolts)

Drilling jigs, examples of, *A*, Chap. VII.

Eccentric work, fixtures for, *B*, Chap. X.

Equalizers, *A*, pp. 293, etc.; *C*, pp. 47 and 171; *F*, Feb. 9, 1928, p. 253

Feet for jigs, *A*, pp. 7, 28, 29; *C*, p. 68

Floating principle, *A*, Chap. XI

Gang fixtures, *Machinery*, Apr., 1925, p. 625.

Handles, knobs, wing nuts, *C*, p. 76; *G*, No. 4 "Jigs and Fixtures"

Hook bolts, *C*, pp. 174 and 178; *F*, Dec. 29, 1927, p. 1019

Indexing, trunnion and roll-over jigs and fixtures, *B*, Chap. XI; *C*, Chaps. V and VII; *D*, p. 101; E, pp. 264-278

Irregular shaped parts, jigs for, *Machinery*, Oct., 1925, p. 133

Jack screws (see also plungers), *D*, p. 56

Jigs, the different kinds of, *D*, Chap. II

Latches and lids, *A*, Chap. VI; *D*, Chap. X, also p. 54; *F*, Feb. 23, 1928, p. 345; *G*, No. 2, "Jigs and Fixtures"

Lathe and boring-mill fixtures, *A*, Chap. X; *B*, Chap. VI

Leaves, *C*, p. 56; *Machinery*, Mar., 1924, p. 544

Locating, details of, *A*, Chap. V; *C*, Chaps. II and III; *D*, Chap. III; *F*, Dec. 15, 1927, p. 933.

Locating, principles, of *C*, Chap. II

Mandrels, *D*, Chap. XV

Manufacturing basis for building jigs and fixtures, *Machinery*, Mar., 1921, p. 632.

Milling fixtures, *A*, Chap. IX; *C*, Chaps. VI and VII; *D*, Chap. VIII; *E*, Chap. XIII

Open jigs, *A*, Chap. II; *C*, Chap. IV

Planing fixtures, *A*, Chap. IX

Plungers and locking jacks, *C*, pp. 48, etc.; *D*, p. 56; *E*, p. 241; *F*, Nov. 24, 1927, p. 803; *G*, No. 5, "Jigs and Fixtures"

Pneumatic fixtures, *D*, Chap. IX; *C*, p. 180

Points to check in designing jigs, *D*, p. 72; *C*, Chap. II; *Machinery*, Nov., 1919, p. 290.

Points to check in designing fixtures, *D*, p. 128; E, p. 233

Profiling fixtures, *A*, p. 233; *C*, Chap. VIII; *D*, pp. 131, 135

Push pins and plugs, *F*, Jan. 12, 1928, p. 47

Riveting fixtures, *C*, Chap. XI

Rotary or continuous fixtures, *C*, p. 205, etc.; *D*, p. 117; *E*, p. 258.

Screws used in jig design, standards for, *Machinery*, Apr., 1916, p. 689

Special jigs, examples of, *A*, Chap. XIII

Spring pins (see Plungers)

Stops, *D*, p. 58; *F*, Nov. 17, 1927, p. 769.

System in toolroom, drawings, records, standards, *D*, Chap. I

T-Slots, standard, *C*, p. 162; *G*, Mach. Design Data Sheets 13, 13*a*, and 13*b*

Tandem fixtures, *E*, p. 250

Temporary jigs and fixtures, *Machinery*, Dec., 1924, p. 292

Thin and irregular work, fixtures for, *B*, Chap. VII

Three-point principle in fixtures, *A*, Chap. XII

Tongues and grooves, *F*, Oct. 20, 1927, p. 613

U-Lugs, *G*, No. 3, "Jigs and Fixtures"

Up-keep, designing for, *A*, Chap. XIV; *B*, Chap. XIII

V-Blocks, *C*, p. 52; *G*, No. 6, "Jigs and Fixtures"

Vise jaws, *C*, Chap. IX; *D*, Chap. XIV; *E*, p. 238

Wedges, *D*, p. 63.

Appendix No. 2—Bibliography

For good practice in design and details the following references are recommended. Part of the material deals with tools and toolholders. Those chapters, only, are listed which deal with workholding devices. They bring together into convenient form much valuable material which has appeared from time to time in the *American Machinist*, *Machinery*, and elsewhere, with additional matter not published in the periodicals. The italic initial letters are used in the references of Appendix No. 1, the subject index.

A "Jig and Fixture Design," by F. D. Jones, Industrial Press, N. Y., 1920

Chapter I Principles of Jig Design
II Design of Open Drill Jigs
III Design of Closed or Box Jig
IV Jig Bushings
V Locating Points and Adjustable Stops
VI Jig Clamping Devices
VII Examples of Drill Jig Design
VIII Boring Jigs
IX Milling and Planing Fixtures
X Adjustable Fixtures for Turret Lathes and Vertical Boring Mills
XI The Floating Principle as Applied to Fixture Work
XII Application of the Three-Point Principle in Fixtures
XIII Special Jig and Fixture Mechanisms
XIV Providing for Upkeep in Designing Jigs and Fixtures

B "Tools, Chucks and Fixtures," by A. A. Dowd, Industrial Press, N. Y., 1920

Chapter V Arbors for Turning, Boring, and Grinding
VI Holding Devices for Lathe and Boring-Mill Work
VII Methods of Machining Thin and Irregular Work
X Methods for Machining Eccentric Work
XI Counterbalanced and Indexing Fixtures

C "Tool Engineering, Jigs and Fixtures," by Dowd and Curtis; McGraw-Hill, N. Y., 1922

Chapter II Fundamental points in Drill Jig Design
III Details of Drill Jig Construction
IV Open and Closed Jigs
V Indexing and Trunnion Jigs
VI Details of Milling Fixture Construction
VII Design of Milling Fixtures
VIII Design of Profiling Fixtures
IX Vise-Jaws and Vise Fixtures
X Broaches and Broaching Fixtures
XI Design of Riveting Fixtures

D "Jigs and Fixtures," by Colvin and Haas, Mc-Graw-Hill, N. Y., 1922

Chapter I System in the Tool Room
II The Different Kinds of Jigs
III Locating Schemes for Drill Jigs
IV Standard Bushings for Drill Jigs
V Some of the Details of of Jig Making
VI Miscellaneous Jig Details
VII Jig Clamps and Clamping Methods
VIII Milling Fixtures of Various Types
IX Pneumatic Fixtures for Holding Work
X Uses and Advantages of the Latch Jig
XIV Designing of Machine Vise-Jaws
XV Construction and Uses of Mandrels

E "A Treatise on Milling and Milling Machines," Cincinnati Milling Machine Company, Cincinnati, Ohio, 1922.

Chapter XIII Milling Jigs and Fixtures

F A series of articles on "Details of Jigs and Fixtures," by J. A. Potter in the *American Machinist*, as follows:
"Design of Bushings," p. 565, Vol. 67
"Design of Tongues and Ears," p. 613, Vol. 67
"Design of Collars," p. 695, Vol. 67
"Design of Stops," p. 769, Vol. 67
"Design of Spring Pins," p. 803, Vol. 67
"Design of Locating Plugs," p. 933, Vol. 67
"Design of Hook Bolts," p. 1019, Vol. 67
"Design of Push Pins and Plugs," p. 47, Vol. 68
"Design of Equalizers," p. 253, Vol. 68
"Design of Latches," p. 345, Vol. 68
"Theory of Clamps," p. 425, Vol. 68
"Design of Shackles," p. 505, Vol. 68
"Design of Clamps," p. 733, Vol. 68
"Design of Combination Clamps," p. 781, Vol. 68

G *American Machinist*, Reference and Data Sheets
Jigs and Fixtures No. 1, "Drill Bushings, Slip Type," p. 69, Vol. 63
Jigs and Fixtures No. 2, "Rapid-Action Jig Latches," p. 325, Vol. 63
Jigs and Fixtures No. 3, "Proportion of U-Lugs for Jigs and Fixtures," p. 597, Vol. 63
Jigs and Fixtures No. 4, "Hand Knobs for Jigs and Fixtures," p. 789, Vol. 63
Jigs and Fixtures No. 5, "Design of Jacks for Jigs and Fixtures," p. 947, Vol. 63
Jigs and Fixtures No. 6, "V-Block Design for Jigs and Fixtures," p. 171, Vol. 64
Jigs and Fixtures No. 7, "Clamps for Jigs and Fixtures," p. 371, Vol. 64
Jigs and Fixtures No. 7*a*, "Clamps for Jigs and Fixtures," p. 609, Vol. 65
Machine Design 13, "Standard T-Slots for Machine Tools," p. 1067, Vol. 66
Machine Design 13*a*, "Standard T-Slots for Machine Tools," p. 1101, Vol. 66
Machine Design 13*b*, "Standard T-Slots for Machine Tools," p. 31, Vol. 67

H Articles in the *American Machinist*, as follows:
"Saving Money by Welding Jigs and Fixtures," Vol. 65, p. 707
"Drill Jigs Embody Standard Construction," Vol. 65, p. 989
"Essentials of the Modern Drill Jig," Vol. 63, p. 58
"Principles Underlying Some Automobile Jigs," Vol. 62, p. 229
"Standard Jig Bushings," Vol. 58, p. 625
Table of details which have been standardized, with references, are to be found in:
Machinery's Handbook, 6th Edition, pp. 1087-97
American Machinist Handbook

I Articles in *Machinery* as follows:
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The Employer and the Worker's Health—*Discussion*

By Harry Kaufman

COMMENTING on the article under the above title on page 772, Vol. 69, of the *American Machinist*, I would like to stress the importance of another phase of caring for the worker's health, and that is, consideration of the employee's eyesight.

Few factors in industry are of greater importance than the keenness of the eyesight of the workers. Systematic and specialized examination of the eyes of their employees has been adopted by many companies.

Enormous strides have been made along lines of artificial lighting to protect the normal eye. However, if industry depended upon normal vision for its output, that output would be even less than it is. The percentage of men and women with perfect eyesight is small.

It is, therefore, not sufficient for management to know that its buildings and lighting are in accord with the accepted standards; it should also be aware in what measure the vision of the individuals employed deviate from the normal.

No Special Equipment Needed for Cutting Cast Iron

IN CUTTING cast iron by the oxy-acetylene process, no special equipment is required. Seemingly, best results have been obtained with the low-pressure, injector-type cutting blowpipe, with which sections 17 in. thick and heavier have been cut successfully. This work can also be done with some makes of equal pressure or pressure blowpipes using special tips or nozzles.

There are some slight differences in the methods of manipulating the blowpipe for cutting various grades of cast iron. Preliminary adjustment of the flame and the oxygen pressure remain the same. Poor grade metal requires a little more heat and cutting will advance less rapidly. A wider kerf will be cut in poor metal than in metal of high quality.

Mechanical Applications of Chromium Plating

By W. Blum
Chemist, Bureau of Standards

The life of measuring instruments is often increased three to ten times by chromium plating—More extended application to machinery can be expected

TWO years ago, in summarizing the status of chromium plating, the author referred to it as the sensation of the plating field. The phenomenal developments in the last two years, especially in the automobile and plumbing industries, have now made chromium commonplace, and before long it will probably entirely supersede nickel as the finish on exposed metal parts of such products.

Most of the applications of chromium plating depend either upon its resistance to tarnish, or upon its hardness and wear resistance. Some uses, such as on plumbing fixtures, involve both of these properties. The present paper will be confined, however, to those articles on which chromium is applied principally in order to increase the resistance to wear or abrasion, and on which appearance is a subordinate or negligible consideration. Even for these uses, however, the protection against tarnish and corrosion that may be furnished by the chromium is an added, though secondary, advantage.

Chromium plating has proved especially valuable on measuring devices, because its resistance to abrasion decreases the tendency for any change in dimensions, or for any obliteration of graduation marks. The latter factor justifies its use on linear scales, verniers, micrometers and tapes.

Chromium has been more extensively and more successfully applied upon plug gages than on other measuring devices. Of the numerous replies received on this subject, all were favorable except one, and the life of the plated gages in service was estimated to be from three to ten times that of the unplated gages.

Technique of Gage Plating

Although it is possible, with proper control of the plating process, to deposit upon a gage exactly the requisite thickness of chromium, and to use the gage without subsequent lapping, experience has led in almost every case to the deposition of a somewhat thicker coating, the excess of which is then ground or lapped off. The data received include thicknesses from 0.0002 in. to 0.004 in. The thickest coatings were applied for bringing greatly undersized gages to dimension. In general the chromium coating should be thick enough so that it will not be penetrated when the gage is worn down to its lower wear limit. It is then a simple matter to strip off the chromium, by a reverse current in a sodium hydroxide solution, and to replate to the desired dimension. While, of course, the minimum thickness required will depend upon the dimensions of the gage before plating, there is no evident advantage in applying more than 0.001 in. of chromium, and for many purposes half that thickness is adequate.

If the gage is made to be about 0.0008 in. undersize in diameter, a deposit with an average thickness of 0.0006 in., corresponding to an increase in diameter of 0.0012 in., will usually be sufficient to leave a thickness of 0.0004 in. after lapping to the right size. If, then, the wear limit of the diameter is 0.0003 in., the gage will still have a coating of chromium about 0.00025 in. thick when it is returned for replating.

Although chromium-plated thread gages are now used in several plants, there is still much uncertainty and skepticism regarding their reliability. This doubt arises from the difficulty of depositing chromium uniformly upon the surface of the threads. In any plating process the deposit is always thinner in a depression than upon a projection, and this difference is accentuated by the notoriously poor "throwing power" of the chromium-plating bath. As a result of the uneven distribution of chromium upon the threads, not only the diameter of the gage, but also the thread angle, is altered.

The data obtained regarding ring and snap gages indicate that chromium plating increases their life to about the same extent as it does on plug gages.

Application to Dies

Very favorable reports were received regarding the value of chromium plating upon dies used for forming sheet steel and brass. In some cases the life of the dies is increased up to eight times the normal service. One special advantage observed with the chromium-plated surface is that the metal does not stick to it as much as to steel. It is significant that the thickness of the chromium coating on these dies is usually less than 0.0005 inches.

In those cases where the metal is formed, or a design produced upon it, by a sudden impact instead of by a steadily applied presure, the chromium coating is of doubtful value. This is because under such severe conditions the chromium tends to flake or chip, probably because the underlying metal, even when it is case-hardened, is at least temporarily deformed. In such cases success is more probable with thin than with thick coatings.

Both spinning and burnishing tools may be classified as forming devices, even though the action of the latter is confined to the surface. Several favorable reports were received upon both of these applications of chromium, though one person found difficulty with flaking of chromium from the burnishing tools. It is not clear

Abstract of paper presented at the annual meeting of the A.S.M.E., December 3 to 7, in New York.

whether this discrepancy was due to the quality of the plating or to the character of the metal burnished. A few observations at the Bureau upon spinning tools showed very favorable results for the chromium.

One of the most successful applications of chromium is upon dies used for molding plastic materials such as rubber, bakelite and ceramic clays. The increased service observed is due not only to the resistance of the chromium to abrasion by particles in the molding compound, but also to corrosion by sulphur, phenol, water, or other substances present in the materials. Large chromium-plated metal sheets are being used successfully in the presses employed to produce insulating materials such as those composed of fiber and condensation products.

The data received regarding chromium on tools used for cutting metals are more variable and less favorable than those for any other uses. The general difficulty may be summed up by saying that if the chromium is thick enough at or near the cutting edge to exhibit its great hardness, it is likely to fracture, and if too thin, it soon wears off the edge and offers little advantage. Nevertheless a sufficient number of successful applications were reported to show that, for some purposes at least, chromium deserves careful consideration. The value of chromium is no doubt affected by such factors as the angle and type of the cutting edge, the speed of cutting, and the material being cut. In at least a few cases, favorable results have been obtained by plating only one side of the tool with a fairly thick chromium deposit. The tool can then be ground repeatedly upon the steel side, thus always leaving a cutting edge of chromium.

Blanking dies furnish a good illustration of the difficulties with chromium plating, especially when they are used on hard metals such as steel. The impact is such that any fairly thick deposit is likely to flake, and thin deposits usually add but little to the service. On the other hand, such tools as milling cutters, reamers, drills, and taps have frequently shown a material increase in service after plating. Even then, however, the results are likely to be erratic. The most consistent gains are obtained when cutting such substances as slate, asbestos board, and bakelite, which materials, though commonly referred to as "soft," cause rapid wear of steel tools.

Plating Saw Teeth

The experience with saws of various types is like that with other cutting tools. If a thick coating is applied there is a marked tendency for the formation of nodules or "trees" upon the points of the teeth. These dull the points, and if, as usually occurs, they break off in service they leave the teeth rough and irregular. For such articles it is therefore preferable to use relatively thin coatings. This conclusion is confirmed by the results reported for hack saws.

The results reported for files were somewhat similar to those for saws, in that any appreciable thickness of chromium tends to dull the files. It was reported by several persons that chromium-plated files show much less tendency to clog in use than unplated files. Whenever a material tends to fill the files, the use of light chromium coatings may be justified, even though the useful life of the file may not be greatly increased. In some cases, however, an increase to double the original service was obtained.

In spite of the apparently obvious applicability of chromium upon all parts of machinery that are subject to wear in service, such use is still far from being a general or even a preferred practice. The failure to adopt chromium for such purposes may be due to various causes, including the size or inaccessibility of many of the parts, and the fear that if the chromium should become detached from a bearing surface, the particles would serve as an abrasive and cause permanent injury to the mechanism. While the latter possibility warrants careful consideration and proper caution, the probability of its occurrence is not evident from the meager data available.

Although the automobile engine is a mechanism upon which the application of chromium would appear promising, very few such uses have ever been made on a production scale. Chromium-plated piston pins, employed on one make of car, owed their selection as much to protection against corrosion by sulphur compounds as to resistance to abrasion. Efforts to plate pistons with chromium have not been entirely successful, though considerable attention is now being given to this possibility on aircraft engines.

One strikingly successful application of chromium plating has been on 9-in. piston rods of Diesel marine engines. These rods run in a cast-iron packing with only moderate lubrication. It was found that the application of 0.003 in. of chromium to the surface of the rods resulted in smoother operation and less difficulty in lubrication. The unplated rods lost about 0.001 in. in diameter for every 5000 miles of service, while the chromium-plated rods required 45,000 miles of operation to produce this same loss in diameter.

Conclusions

Chromium plating owes its application upon mechanical equipment primarily to its great hardness, as exhibited in its resistance to abrasion. The chief limitation in the use of chromium for such purposes is its extreme brittleness, which may cause it to crack and flake when deformed. The most successful mechanical uses of chromium are upon measuring instruments such as gages of all types, the service of which is often multiplied several fold. Upon forming and molding dies it is generally satisfactory and beneficial, especially if the conditions do not involve too severe impacts. Upon cutting tools it is of doubtful value, though in numerous applications it has proved successful. Upon moving parts of machinery there have been but few successful applications, but these indicate that with further study many such uses may be developed.

It is impossible to estimate even roughly the savings that have been or may be accomplished through the use of chromium on mechanical equipment. The cost of the tools or devices that may be dispensed with because of the greater life of those that are chromium plated, represents only a small part of the economic gain. The money saved in reducing the number of times that a machine must be stopped for replacement of a tool or die may amount to many times the cost of the device. Perhaps the greatest gain is the somewhat intangible but far-reaching benefit arising from the manufacture of more uniformly dimensioned parts, whereby the useful life of a machine may be materially lengthened.

Chromium plating is not a panacea for wear. An everlasting tool or machine is as visionary as perpetual motion. Chromium plating has, however, solved many machine-shop problems, reduced costs of operation, and improved the quality of the products. There is good reason to hope that with the large number of investigators now at work even greater results may be expected.

Methods of Motor Application and Control

A Symposium Presented at the Annual Meeting of the A.S.M.E., December 3-7, in New York

Motors for Planer Service

By F. E. Cardullo
Chief Engineer, G. A. Gray Company

THE most satisfactory method for driving planers of medium and large size is by means of a reversing motor geared directly to the planer drive. Such motors are, with negligible exceptions, direct-current, shunt, or compound-wound motors. A few alternating-current motors of the induction type have been built but such a motor is more expensive and less efficient than a direct-current motor, and gives at most but two cutting speeds, which is obviously too few.

Because of superior electrical and mechanical advantages practically all reversing planer motors are of the adjustable-speed direct-current type. Such motors may be divided into two classes; constant-voltage motors, and variable-voltage motors. Most planer motors are of the constant-voltage type and have a speed range of from 250 r.p.m. to 1000 r.p.m. These motors are usually of special design, the armature being made long and of small diameter in order to reduce the moment of inertia, or "flywheel effect," and to facilitate prompt reversal. Because of the reversal of rotation, in order to secure sparkless commutation it is necessary that the motor have interpoles, and on account of the heavy peak currents, and also of the low flux density at high speeds, it may be desirable that the pole faces be provided with a compensating winding in which a current flows which is equal and opposite to the current flowing in the armature.

Lately constant-voltage motors having a higher speed range have been brought out, but such motors have not yet become standardized and different makers have not yet fixed upon the same speed range. The preferred speed range from the standpoint of planer manufacture is from 200 to 1,200 r.p.m.

The variable-voltage drive consists of a planer motor of the same design as has already been considered, which is supplied with current by a motor-generator and exciter set. This set consists of a high-speed motor which may be of either alternating- or direct-current type, a 220-volt generator, and an exciter generator, all mounted on the same bed plate. Where a wide speed range is desired this outfit performs excellently.

The art of control design consists in so balancing the various operating coils and resistances as to reverse the planer in the shortest possible time. The more nearly the armature current can be maintained at the highest value within the heating and commutating limits of the motor, the quicker the reversal will be. The armature current during reversal is not a constant quantity but falls off with increasing motor speed, rising temporarily each time that resistance is shorted out by one of the relay coils. Its effective value during the period of reversal is usually about 1.75 times the rated load current.

To illustrate the action of a reversing motor and give an idea of the loss of time due to reversal, assume a motor of 25 hp. at 250 r.p.m. set to run at 350 r.p.m. on the cut and 1,000 r.p.m. on the return. Assume that the radius of gyration of the armature is 0.416 ft., that the mass of the armature is 610 lb., and that the equivalent mass of all the moving parts at that radius is 700 pounds.

In order to get an idea of the "efficiency of reversal" of such a system, assume a gear ratio of ten motor revolutions equals one foot of table travel and consider the least efficient length of stroke which will give for an instant 100 ft. per min. return speed when the cutting speed is 35 ft. per min. The length of stroke will be 1.736 ft. The time theoretically required for a round trip will be 0.0670 min. The actual time per round trip is 0.08294 min. The efficiency of reversal is therefore 80.8 per cent.

In this computation we have not considered the effect of friction which sometimes assists and sometimes retards reversal.

In order to compare the action of a reversing motor with that of the old-style belt drive, assume a belt-driven planer operated by 4-in. double belts, capable in practice of transmitting about 15 hp. in a planer drive. Theoretical time for round trip is 0.0262 min. The actual time for cycle is 0.03538 min. If the stroke were the same as previously considered for the reversing-motor planer, the efficiency would be 88 per cent.

It will be seen that for short-stroke work the belt drive will give a much higher efficiency of reversal. However it gives only one cutting speed, lacks power, and the shriek which it gives under certain weather conditions is annoying. Unless a large proportion of the work requires light cuts and strokes of under two feet, the reversing-motor drive will be found to be more satisfactory for all planers except light machines of 36 in. width and under.

Application of Motors to Special Drilling and Tapping Machinery

By J. H. Mansfield
Chief Engineer, Greenlee Bros. & Company

THIS paper deals with the application of motors and controls to single-purpose, multiple fixed-spindle way drilling, tapping, turning, boring, and facing machines, and the advantages of variable and multi-speed motors.

The drilling machines discussed have two multiple-spindle heads mounted at each end of a horizontal bed with a work-holding fixture between them. The head motors are usually for alternating current and are of

from 1 to 25 hp. The ball-bearing fully enclosed fan ventilating type is recommended. A speed of 1,150 r.p.m. is used on all except small motors, as the tooth speed of the motor pinions is not excessive at this speed. In our practice the armature shaft is keyed to the motor pinion, which is carried in a radial ball bearing or in two Timken bearings in the rear wall of the head.

Motors from 1 to 25 hp. have been used successfully, driving up to 65 taps in one head. Above 5 hp., normal-torque general-purpose high reactance motors are used entirely, since the reversal of the current takes place so quickly that automatic compensators will not function. The reversal of the motors is so uniform that the heads will stop within very close limits, making the tapping of blind holes safe.

The superiority of the above motors is best brought out in a single-purpose cam-feed machine. The operation is turning the outside diameter and facing both sides of a flange. Both rough and finish cuts are taken. The flange in this case is 20 in. in diameter and the front face is $1\frac{5}{8}$ in. wide. With a single-speed motor and normal cutting speeds and feeds, a piece is completed in 8.3 min.

A new type of motor has been developed in the last few years known as the "can" type, and is used almost exclusively in the woodworking-machinery field. It consists of a rotor and stator only. The stampings of the stator are held together by a thin steel sleeve about $\frac{1}{16}$ in. thick with its ends spun over the ends of the stack of stator stampings, binding them together—thus, the name can type. The motor manufacturers furnish the two parts and the woodworking machine manufacturer mounts them in special housings to meet the conditions in the various types of machines. These motors can be had from a very small fraction of a horsepower up to 30 hp., and at various standard alternating-current motor speeds up to 3,600 r.p.m. for 60-cycle current, and there is no reason why can-type motors cannot be as successfully used in metal-working as in woodworking machines.

Methods of Motor Application and Controls on Lathes

By Chas. L. Cameron

Eastern Representative, Monarch Machine Tool Company

SINCE there has been little or no standardization among motor manufacturers of frame sizes, armature-shaft dimensions, motor bolt-hole dimensions, etc., the application of a motor to a lathe is a case of fitting each one individually. To provide for the many varieties of motors the manufacturer must design his machine so as to take almost any motor that may be selected. All machine-tool users as well as manufacturers will welcome the day when the motor manufacturers, standardize on the essential points.

While the first cost of installation of the countershaft group drive is considerably less than for the self-contained individual motor drive the majority of production engineers agree that in the long run individual motors are the more economical.

The effective means of keeping down the original cost of installation on motor-driven lathes is not to over-motor the machine. There has been a tendency among builders of machine tools to recommend motors of far greater horsepower than is actually necessary. The frequently noted fact that a motor of comparatively small power will drive a considerable group of machines, indicates the frequent over-motoring of individual machines.

Another factor materially lessening the horsepower required to drive a lathe is the more generous use of anti-friction bearings. While on the subject of anti-friction bearings we find a very decided swing in demand from plain-bearing motor shafts to motor shafts mounted in improved anti-friction bearings. The reason for this is obvious. Many of the best regulated production plants in the country will install nothing but motors equipped with anti-friction bearings. Our own plant is one of these.

Motor Drives for Precision Grinding Machines

By R. E. W. Harrison

Engineering Director, Cincinnati Grinders Incorporated

FOR many years the cumbersome countershafts and the multiplicity of belts which characterized the earlier types of grinding machines imposed a handicap on production in the average machine shop. It was therefore only a matter of time before serious attention should be given to the elimination of countershafts. Particularly was this necessitated by the improvement made in the metal-removal capacity of grinding wheels, calling for the application of much more power to the point of contact between the grinding wheel and the work.

The most prolific source of difficulty in the way of successful grinding operations is vibration, and until it is possible for motor manufacturers to produce motors which are free from vibration, it is doubtful if the practice of mounting the motor directly on the grinding-wheel spindle will become general.

Machine-tool manufacturers, of course, realize the difficulty which confronts the motor manufacturer, this difficulty being due to the nature of the materials which the motor manufacturer has to use to attain his results. However, it is only a matter of time before an armature will be produced which will have the virtue of permanently correct dynamic balance, and it will be then only a very short time before practically all motor-driven grinding machines will be made with the main drive motor as an integral part of the wheel head.

The motor manufacturers, in common with other makers of industrial machinery, have introduced a ball-bearing or roller-bearing product. Up to date, however, these motors have not been as satisfactory as the sleeve-bearing type, owing to the fact that they have not the same ability to damp out minute vibrations as have the well-lubricated sleeve bearings.

Grinding-machine manufacturers have for many years made a study of anti-friction spindle bearings for grinding machines, and it is only within the last three years that it has been possible to mount a heavy-duty spindle of, say, 30 to 50 hp. capacity on anti-friction bearings in such a way that the factor of reliability has been commercially attractive. Improvements in material and limits of accuracy in the manufacture of anti-friction bearings have made it possible to utilize the pre-loaded mounting, the pre-loading in some instances running as high as 3000 lb. between bearings, thereby insuring what is to all intents and purposes a continuous metal-to-metal contact whatever the load. This method of mounting calls for the use of selected anti-friction bearings, and it seems that it will always be necessary for the process of selection to be used. Commercial anti-friction bearings without pre-loading result in chattering.

Welding Low-Resistance Metals

By P. T. Van Bibber

ELECTRIC resistance welding of metals such as copper, brass, silver, and platinum always presents more difficulties than when this process is applied to iron, steel, or their alloys. In the latter materials the resistance to the electric current producing the heating effect is divided between that of the joints between pieces and electrodes supporting them, and the resistance of the metals being welded. With low-resistance materials the heating effect is controlled to a considerable degree by the resistance of the joints, since it becomes a larger component of the total between the electrodes. This accounts for a variation at times in the quality of the welding of pieces that are identical in shape. Variation in the power line voltage is also a serious drawback in trying to get uniform welds on low-resistance material.

With any given voltage the variation of current flowing across the joint of two pieces to be welded may be due to the amount of pressure applied or to surface resistance due to grease or oxides. On small work, whether butt welding horizontally, or spot welding vertically, a definite spring pressure is necessary. If the mechanical parts of the machine operate freely, uniformity of this component can be obtained. If the pressure is uniform with each weld and the voltage constant the remaining variable is the condition of the pieces at the surfaces of contact with respect to each other and to the electrodes. While heavy pressure will overcome the resistance of a thin film of oil, it will not help much to cut through a heavy coating of oxide on the contacting surfaces.

If the machine is a power-driven spot welder with a definite time dwell of current on, variations in the strength of the welded joints are bound to occur. With hand control of the current the operator is able to favor the retarded heat effect by holding the switch in longer. However, even with hand- or foot-operated machines greater uniformity of work can be produced by cleaning the pieces prior to the welding operation. With small parts this is accomplished by dipping them in a hot potash solution. After washing in hot water the pieces are dipped in a hot pickle bath, strong enough in sulphuric acid to remove all traces of oxide coating. From this they should be again washed, dipped in cold cyanide solution, washed in hot water so as to dry off quickly and then welded before oxidation can set in again.

Variation in Voltage Noticeable

Variations in the power line voltage of even a small percentage are very noticeable with low-resistance materials. As an example, in welding a brass screw on a copper plate, if the line voltage is about 230 and the control switch on the welder transformer is set at a point to give 1.9 volts secondary on open circuit, at which value we will assume the pieces fuse perfectly with a given time dwell, it will be observed that a rise in the line to 235 volts, producing 1.94 in the secondary, will cause burnt metal to spurt out at the joint. On the other hand, a drop in the line to 225 volts, which lowers the secondary proportionally to 1.86 volts, will produce doubtful joints, and if there is a machining operation immediately following, many of the pieces will come apart at that time. Yet the variation is only a little over 2 per cent in each case.

There are examples of regular spot or butt welding which would of course not be greatly affected by variations in voltage up to possibly 5 per cent. However, this is frequently the chief drawback in attempting to produce the same quality of work with increased production with a power-driven machine as has been turned out successfully by a hand- or foot-operated type. With the latter machines the operator could easily offset the fluctuations in line voltage by varying the time dwell of the heat at each weld.

There are two general classes into which voltage variation may be divided, in so far as it concerns the operating of welders on low-resistance materials, each with a different suggested remedy. If, on the low side of the power transformers there are motors or electric furnaces operating with constantly varying loads so as to cause a continual intermittent variation of line voltage at the welder with serious results, the only remedy is to provide a separate transformer for this particular service.

Usually the primary supply of power lines is not subject to intermittent variations of very noticeable degree, and the separate transformers will cure the trouble at its base. When the line variations are periodic due to gradual load additions in the neighborhood, which cause the primary line voltage to rise and fall 5 per cent or more, the fluctuation can be observed easily by the operator with the installation of a voltmeter. This instrument should be easily visible at all times while he is running the welder, and he can then move the control switch as occasion demands to keep the secondary voltage of the welder transformer about constant as the primary varies. To make this method more positive a volt meter can be procured with mercury limit contacts so as to give an alarm through an operating relay or to interrupt the circuit and stop the machine, if it is a power-driven type.

Modifications in Transformer

With some commercial spot welders it is found occasionally that there is too great a difference in secondary voltage between the taps of the transformer, so that with certain values of the line voltage it is not possible to obtain exactly the right secondary value for best heating effect. In this case it is advisable to remove the transformer and on either side of the tap most commonly used have additional leads brought out from points on the primary winding half way to the next tap in each direction. For instance, if with a five-point switch on the welder it is found that points two and three are most commonly used, but are not near enough in resulting heat control, extra leads should be added to the primary winding so as to tap the turns midway between points one and two, two and three, and three and four.

While this would make possible eight points of switch control, it would not be necessary to install a new switch. By connecting the new lead between taps one and two of the original arrangement to point one of the control switch, then former tap two to point two, new lead between old taps two and three now going to point three and so on, five points of switch control are still available with twice the sensitivity that was obtained originally. Old leads one, four and five in this case would be merely taped up and not used. This work can be accomplished easily by the average plant electrician in about a day's time. A motor rewinding shop can make the change, if the plant does not maintain a regular electrician.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Preventing Spoiled Work

"WHAT'S broke loose now?" spoke up Ed, as he and Al paused on their way out of the factory to read a new notice on the bulletin board. " 'Is eighty-five per cent of spoilage avoidable?' That's a hot statement!"

"Guess Williams is trying to get us thinking about spoiled work again, Ed. He's just been attending a convention, you know. He was telling me yesterday that one speaker said that much spoiled work was because men were not instructed properly."

"Sounds a bit fishy to me, Al. Guess some one wants a job as instructor in some shop. But I don't want any of them around here."

"I've been thinking about it a lot, Ed, and I'm not sure but there's something to it."

"Bunk. Most of it is pure carelessness on the part of the men. Take those shafts Pete Wormser spoiled last week because he didn't put good centers in the ends. Any man ought to have known that."

"That's just the trouble, they don't know. You couldn't have picked a better example to prove my side of the argument. If Pete had been trained right he wouldn't think of trying to turn anything without proper centers. He's either seen someone turn rough stuff with shallow or centerpunch centers, or he's never been told how necessary good centers are for good work. If someone had taken pains to really teach Pete, he wouldn't have spoiled those shafts."

"Perhaps you think that's part of my job? Well, I don't. I have trouble enough to keep work going through the shop without running a kindergarten for machinists."

"It isn't so much a question of being your job, Ed, but if it had been someone's job we wouldn't have those spoiled shafts chalked up against us. If your sub-foreman had watched Pete a bit he wouldn't have spoiled more than one shaft at the most. But the question is—is it cheaper to spoil work or teach men so they'll do it right?"

"But we ought to be able to hire machinists who don't make mistakes of that kind."

"What we ought to do and what we can do, are mighty different, Ed. Hardly any shop trains boys thoroughly enough to fill the bill. It seems to be up to the shop either to train men or accept more spoiled work than seems necessary.

"Think it over, Ed, and I guess you'll agree with me that we all need instruction all our lives. There aren't any finished mechanics any more, and it's up to the foreman to avoid an excess of spoiled work."

Is a large part of spoiled work unnecessary? Is Al right in feeling that someone in the shop should train men as well as boys? Or is Ed right that it is largely carelessness?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Capitalizing Criticism

ANY successful business represents an accumulation of the ideas of many men. Permitting the foremen to get together and give expression to their ideas is a good way of obtaining new ideas and points of view on intimate shop problems. The criticism of other departments, however, should be given with a view to helping the company, not hindering it.

The method adopted of having foremen meet and discuss questions relating to factory management and production will aid in bringing out new ideas for the betterment of existing conditions, and will also aid in securing greater co-operation between the different departments. The foreman of each department will learn something about the work being done in the other departments.

—S. KUPPER.

Making Foremen—or Importing Them

IT IS hard to believe that anyone would advocate going outside for a foreman if there was any possibility of promoting a man in the organization. A progressive manager makes every effort to fill positions of responsibility in all departments by developing his own men. Work in a manufacturing department does not, however, always qualify a man to be foreman. Usually some technical training or knowledge of machinery is essential, and thus the manager often looks to the machine shop or toolroom for material for foremen or supervisors.

If the men are interested in their work and know that adequate rewards are given, it will not be necessary to get outside men for new ideas, as the men themselves will keep in touch with the newest and best practice. Another advantage to the company from a policy of promotion from within is the detailed knowledge acquired by one who has been a part of the organization, and therefore knows the men, methods and established practice. In fact, there are many positions in industry that could not be filled successfully by an outside man except after a long and expensive period of training.

—P. C. CORNISH.

Handling the Shop Office

ED SHOULD avoid similar occurrences by looking through all of the incoming correspondence himself before it is assigned to the various clerks. If he has some information which a clerk is unlikely to have, he should attach a note to the letter that he be consulted before replying. All outgoing correspondence, except possibly regular routine work, should go to Ed to be signed before it is mailed. By this method he will eliminate chances of having wrong or insufficient information sent out from his department, without having to do all the office work himself.

—E. H. INGRAM, *England*.

THE · NEXT · TOPIC

The Foremen's Ideas on Pensions

ADVANCE QUESTION

The management is considering the matter of pensions, and calls in Al to sound out the shop. The two foremen have opposite views. As a foreman, what is your idea?

Asking a Man to Come Back

AL IS most certainly right in advising Ed to reverse his action and hire Frank again. There is nothing that will arouse opposition among workmen more quickly than will the conviction that the foreman isn't playing fair. And once they get that idea, drastic measures are required to correct it

The case in question is really a great opportunity—rather than the misfortune that it now seems. If Ed will call Frank, tell him that he realizes the mistake on his part, and ask him to accept his old position again, he will not only be making a friend of Frank, but will be proving to his men that he is really fair.

When employees feel that one of their number has received a crooked deal, it lowers the morale of that group. Ed couldn't possibly make things worse than they now are, and as for his fear of loss of discipline if he calls Frank back, he need not worry. The men will understand that he isn't afraid to do what he feels is right, and they'll like and respect him a lot more for having the courage to admit his mistake.

—B. E. STANLEY.

Finding New Ideas on Shop Visits

EVALUATING an idea is one of the hardest problems in industry, because all the interest in the problem is manifested at the inception of the idea, and not after it has actually worked out. Therefore, establishing its value is a matter of opinion rather than fact. Those who favor it, overestimate it, and those opposed minimize it. Nevertheless, it is quite possible that in a production organization two good ideas will pay the relatively low costs of an inspection trip.

The real value of such a trip, however, lies more in the intangible good effect on the individual who has

made it. He has acquired a broadened viewpoint, and even years after, he may find effective use for an idea he has stored away in his head, whose very origin he has long since forgotten. To the truly active man such an inspection trip has a better mental effect than a vacation.

—Edward J. Gorman.

Does Appearance in Tools Count?

WITHOUT doubt a handsome looking tool is accorded much better treatment than one which does not look as pretty, but is this better treatment worth what it costs? Any good toolmaker delights in doing a pretty job, but the cost of such fancy work is usually prohibitive and unnecessary. All tools are made for the purpose of increasing the quality and quantity of parts in process, and to be economical must be made as cheaply as possible consistent with the accuracy involved.

Thus, the utility of the tool is the prime motive for its being made, but utility and good looks can be combined. A jig, fixture, die, or tool of any kind should be designed in such a way that it has a neat, compact appearance, and requires a minimum amount of machining. All its levers, stops, clamps, screws and other parts can be made neatly and quickly at the same time, and by using a little ingenuity and skill the good toolmaker, without losing any time, achieves a neat appearance while he does the necessary machining for the required accuracy.

—L. O. Brown.

Wear Goggles or Quit

GRINDING without goggles is safe on light work, such as tool grinding, if the wheel is equipped with a swinging glass shield in addition to the usual cover or guard. This glass shield should be hung in front of the wheel, and high enough up to permit the tool's being ground under the glass. When properly installed, the device will keep all sparks and grit out of the eyes.

—F. H. Schley.

The Boss's Son in the Shop

EVEN if the foreman actually carried out the father's instructions as to treatment of the son—and there may be such a foreman, somewhere, who takes so little interest in his own welfare as to risk antagonizing his future boss—much would depend upon the boy himself. Even an unusually self-reliant boy, who was willing to subject himself to the shop routine, would be inclined to kick back at a severe "bawling out" such as the other apprentices would have to take without a word. Either the foreman would have to discharge the boy, which he couldn't do, or the discipline of his shop would be shot full of holes. No, the only way for the boss's son to learn his trade from the ground up is to get a job in some shop where he isn't known, and among men who need never think of him as their future boss.

—Francis M. Weston.

FOURTEEN years' experience as the boss's son in the shop ought to give me a certain prestige. It wasn't convenient to have me work during my early teens in someone else's plant. There really isn't any particular disadvantage or advantage to the boss's son working in the plant before he is twenty, but I feel that, after leaving college, it would have been infinitely better to have spent at least five years working for somebody else, in somewhat the same line of business, or better still, to have tried successively several different kinds of business. If a boy has a tendency to loaf on the job, or to slide along on the line of least resistance, it is pretty hard to keep him on the track in his father's business, and next to impossible to get anybody to treat him as anything but the boss's son.

As I look back at it, I can't think of any real good reason why a boy should start in his father's business if there is any chance of his getting anything like the same training somewhere else. The only advantage is that he can be passed rapidly from one department and position to another, and get a smattering of knowledge of the whole business, but very often "a little knowledge is dangerous."

—Dean B. Gregg.

Holding Back on Piecework

AFTER twenty years of active participation in production work, covering a wide range of operations and products, it would be my impression that the tendency to "hold out" piecework output in such a manner as to produce a rough average day's work, varies in direct proportion to the employer's reputation for rate cutting.

Human nature is not a great deal different among piecework mechanics from that to be found among any other class of humanity, and, while the average inclination among men may be toward honesty in their dealings, the primal urge has always been to resent unfairness, and to defend oneself against the effects of such unfairness.

—D. C. Wright.

MY EXPERIENCE has been that piece-rate workers when able to turn out more work per day than their average, do hold out the average to apply to some day, when for various reasons, they cannot make their average amount of work. Frequently the workman has no stock on hand for half an hour or more, or the equipment may break down, which means more lost time. Of course, where a group system of pay prevails and the group is paid for the goods made each day, there is no opportunity to hold over any earnings.

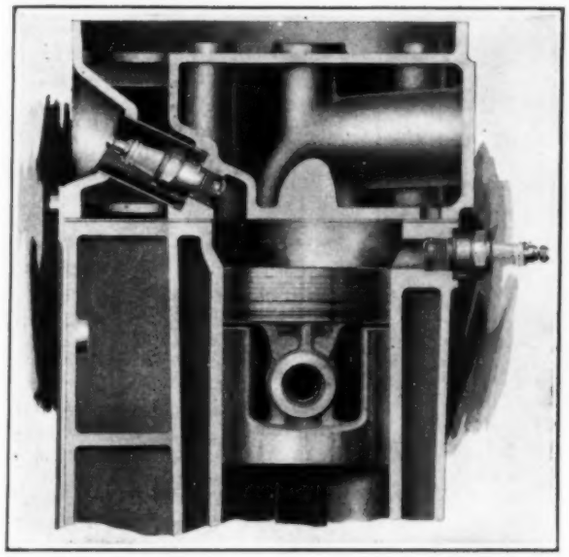
I believe that if the piecerate prices are set by a capable foreman or time study man, that each workman should be made to turn in all he is capable of earning each day. Also, the company should agree that any prices set should remain effective for one year, unless a change in manufacturing methods or equipment is involved.

—H. R. Hay.

Equipment and the Foreman's Reputation

THE holder of an executive position has to keep a jealous watch on his reputation, and it certainly would not be improved either by getting fired or by staying with a firm which he was certain would go down. Some, at least, of the opprobrium of failure would cling to him. Only yesterday, I interviewed an applicant for a position as cost and statistical clerk whose past few years had been spent in similar work with a firm which is, at the present moment, being sold out. The latter fact did not assist him to get the post.

—C. Norman Fletcher, *England*.



Changes Required in Building the Nash

Twin-Ignition Motor

By FRANK W. CURTIS
Western Editor, American Machinist

Fig. 1—Cross-section of the twin-ignition engine

IN CHANGING the series 400 Nash motors, advanced- and special-six models, from single- to twin-ignition, a comparatively small number of changes were required in the manufacturing department. Briefly summarized, the revised cylinder block requires two additional operations, one being the drilling and tapping of a duplicate set of holes for the extra spark plugs, and the other constituting the drilling and tapping of a hole at the center of the block through which is assembled a tube that carries the ignition wires from the distributer side of the engine. The cylinder head remains the same as for the single ignition system, having the usual set of spark-plug holes located as before. Some additional parts have been required, of course, these being chiefly the tube and lock nut, a support for the extra ignition wires, the added spark plugs and leads, and one additional coil. The distributer has been changed and enlarged to accommodate twelve spark-plug wires instead of six, and has two breaker bars, two coil wires, and two primary connections, but the battery and the generator are similar to those used in the preceding models. A sectional view of the advance six-cylinder assembly, showing the relative location of the spark plugs, is illustrated in Fig. 1. Details of the holes as finished in the cylinder are illustrated in Fig. 2. As shown, the holes enter the bore at the combustion chamber, and flush to the top of the piston at the end of its stroke.

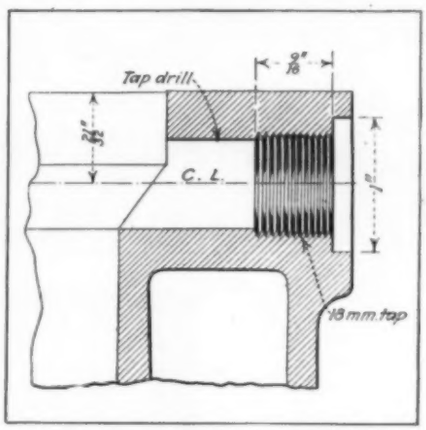


Fig. 2—Details of the spark-plug holes in the cylinder block. They are similar to those in the head, and require to be drilled, tapped and spotfaced

For drilling and spotfacing the spark-plug holes, the block casting is located horizontally in a six-spindle drill press from the combustion-chamber hole of No. 4 cylinder, and rests on two hardened plates from the valve side. A swinging clamp seats the top face of the block against an upright member of the fixture. The set up is illustrated in Fig. 3. One operator handles this operation in connection with the finish reaming of the camshaft bearing hole, which is done in the machine shown at the left. The multiple drill is of the power-feed type, so that loading and unloading, and the starting of the feed are the only manual duties required, thus giving the operator ample time to handle other work. Combination cutting tools are mounted in the spindles, enabling the drilling and spotfacing to be done simultaneously. Approximately 350 blocks are turned out daily. For convenience in handling the work from one machine to the other, and to the roller conveyor, an overhead air hoist is used. When the cylinders have reached the proper position in the line, the holes are tapped singly in a radial drill. This operation is done in connection with several others, the block being located in a trunnion jig mounted on tracks, therefore, no additional tooling has been required. The drilling, reaming, spotfacing and tapping of the crosshole in the block is handled in the special machine shown in Fig. 4. Location of the block is from one of the combustion holes, and clamping is by swinging-type strap clamps. The machine has two horizontal spindles that are operated independently. Quick-change chucks are used to facilitate changing of the tools required. The ignition-tube hole, showing the tube in place, is illustrated in Fig. 5. The center portion of the tube enters the water chamber, so for this reason the joints at each end must be made water tight. The tube is assembled at the end of the cylinder line before the blocks are washed, and prior to the water test.

In all, only three additional machines were required to complete the machining of the new-type cylinder blocks, namely, a multiple-spindle drill, a radial drill and a two-spindle horizontal drill. Rearrangement of the equipment to suit the additional operations was easily handled, constituting the moving of two machines only to make room for the six-spindle drill. The other machines were set up at available spaces along the cylinder line.

From an inspection viewpoint, the additional machining operations add only a few minor inspections to the block. For the spark-plug holes, a go- and no-go thread gage, and a location gage that checks the center line of the hole with the top face of the block, are used. Both

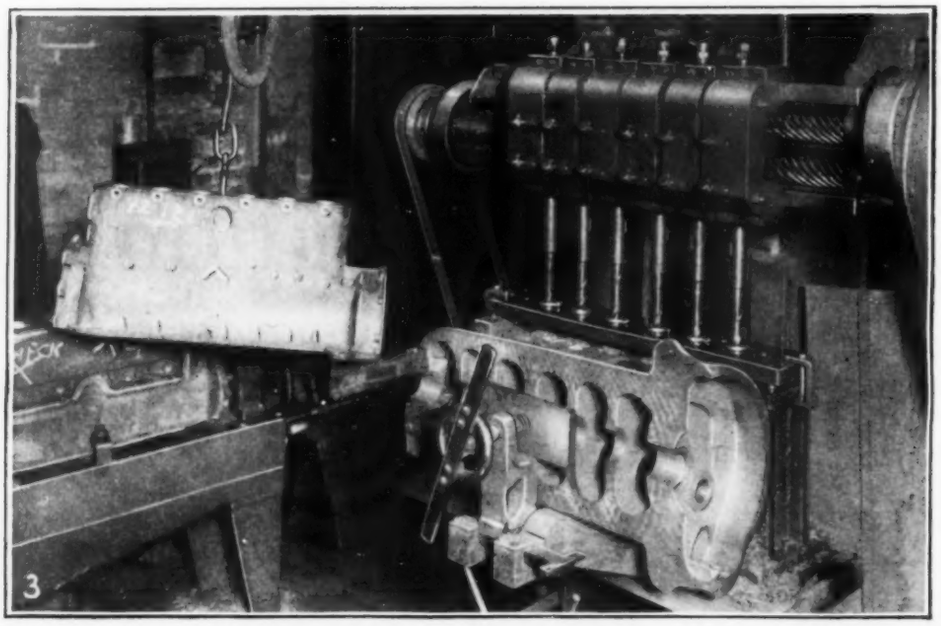
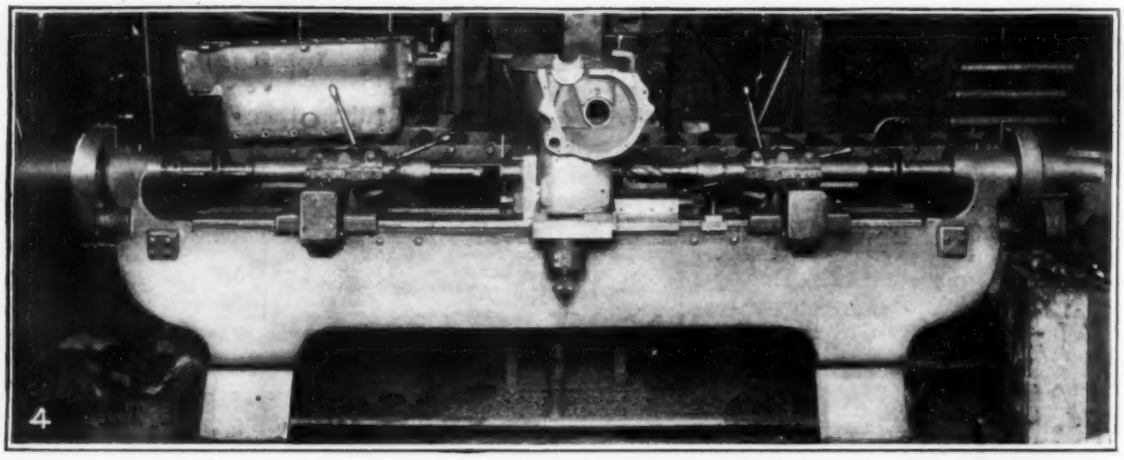


Fig. 3 — Drilling and counterboring of the spark-plug holes is handled in a six-spindle drill press, equipped with a fixture that aligns the block from the valve side and one of the bores. At the right is shown the air hoist by which the work is brought from the machine handling the preceding operation to the multiple drill

Fig. 4—In order to bring the ignition wires from the distributor to the opposite side of the motor, a tube is put through the central portion of the block. The hole for the tube is drilled, reamed, spotfaced and tapped in a two-spindle horizontal machine. The work is located from one of the bores



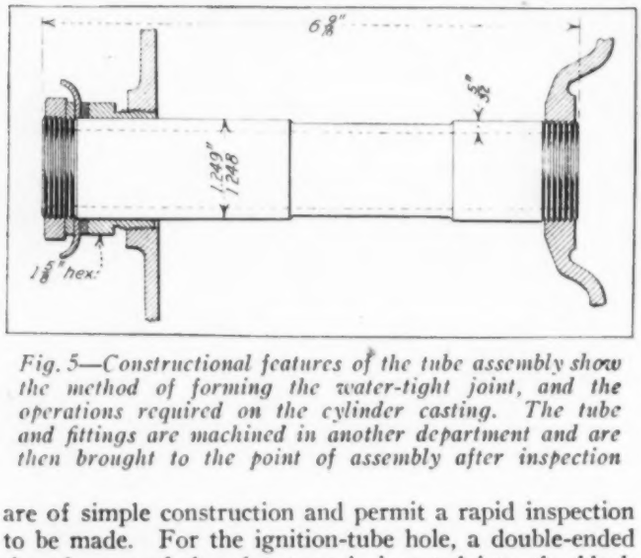


Fig. 5—Constructional features of the tube assembly show the method of forming the water-tight joint, and the operations required on the cylinder casting. The tube and fittings are machined in another department and are then brought to the point of assembly after inspection

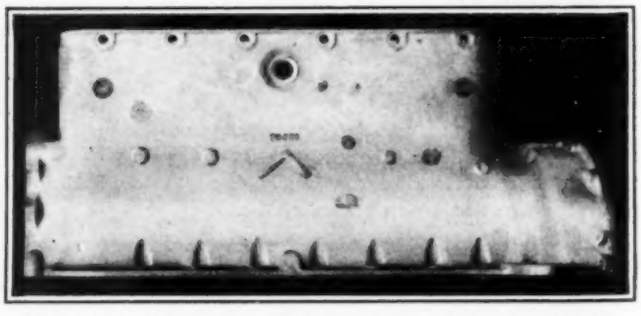


Fig. 6—A finished cylinder block, showing the left side with the added spark-plug holes and the ignition-tube hole

are of simple construction and permit a rapid inspection to be made. For the ignition-tube hole, a double-ended thread gage of the plug type is inserted into the block to check the alignment of the holes in both sides. Plug-thread gages are also available for inspecting either tapped section separately. The tubes are inspected before they are brought to the cylinder department.

The left-hand side of the advanced-six motor block, showing the arrangement of the spark-plug holes and the large hole for the ignition tube, is illustrated in Fig. 6. In this view the tube has not been put in place.

The foregoing information was obtained from the Nash Motors Company.

Much of the difficulty connected with the welding of non-ferrous metals such as aluminum can be traced to "dirt." Refractory oxides are quick to form and therefore the pieces should be thoroughly cleaned before actual welding begins. This precaution will assist the flux in floating off additional impurities as the weld progresses and save much time and money.

Instructing Apprentices *for Railroad Work*

By E. B. Baker

Supervisor of Apprentices, Wabash Railway Company

AFTER a lapse of several years without an apprentice instruction department, the Wabash Railway Company decided to institute an apprentice training system, taking active steps in this direction which culminated in the establishment of a school of instruction at the Decatur, Ill., shop in the fall of 1927. The start was made by distributing a bulletin asking each apprentice then in service how much time he had served to date, his age, his family connections and responsibilities, and specific reasons as to why he took up this particular trade. After compiling and classifying this information, the shop superintendent called a meeting of the supervisor of apprentices, the apprentices, the shop foremen and the committees of various shop organizations. At the meeting an outline of the work to be taken up was discussed, the apprentices were given to understand what would be done for them and what would be expected of them in return, and a few simple but strict regulations were laid down in regard to attendance and attention so that there would be no later misunderstanding which might lead to some unpleasantness.

NAME			
LOCATION	DATES	LOCATION	DATES
Distributing Tool Room		Steam Gages & Safety Valve	
Upright Drill		Links & Motion Work	
Radial Drill		Cab Fittings	
Bolt Lathe		Steam Pipes & Throttle	
Finishing Lathe		Boosters & Stokers	
Large Roughing Lathe		Driving Boxes	
Brass Lathe		Guides	
Turret Lathe		Shoes & Wedges	
Shaper		Rods	
Planer		Spring Rigging	
Slotter		Valve Setting	
Boring Mill		General Floor Work	
Bullard Mill		Round House	
Tool Room Miller		Car Shops	
Tool Room Grinder		Inspecting Finish Pit	
Injectors & Lubricator			
Air Pumps & Triplex			
Air Brake Appliance			
Power Rev. Bell Ringer			
Pistons, Crosshead			

A schedule is made out for each apprentice, so that a complete record of past performance can be obtained at any time. The work completed is graded according to the ability of the apprentice, the marks being determined by a shop instructor in conjunction with the shop foremen. Job changes are made at periods of six weeks

Apprentices are taught one hour per day on their own time which is the hour after closing, namely 3:30 to 4:30 in the afternoon, and school sessions are held five nights a week. Since twenty to twenty-five boys make an easily handled class, the apprentices are grouped as follows: Class No. 1—Monday, machinists in the first two years; Class No. 2—Tuesday, advanced machinists, or those serving the last two years; Class No. 3—Wendesday, beginners in various trades, such as sheet metal, boilermakers, carpenters, and electricians; Class No. 4—Thursday, advanced apprentices of the same crafts listed on the Wednesday night schedule; and Class No. 5—Friday, apprentice car men.

The basic principles of all mechanical trades are founded, of course, upon mathematics and mechanical drawing. While the question may arise as to why such apprentices as sheet metal, boilermakers, carpenters and electricians are taught in the same class, the answer is that the fundamentals for these trades, mechanically and mathematically, are the same, and that shop instruction must be gained wholly in the shop and not in the apprentice school. The object of the apprentice school, therefore, is to see that apprentices gain a basic education in the theory of their trade, in order to permit them to advance to supervisory capacity when the time comes for them to do so. We do not stress in the class work any particular phase of railroad mechanics, yet there are certain phases of work that are peculiar to railroad work only, such as Interstate Commerce Commission rules and A.R.A. rules. These rules are given out to the classes requiring them. At present there are 52 machinist apprentices who are scheduled to change jobs at the end of each six-weeks period. Changes are made on a time basis in all cases, regardless of shop interference with production. The machinist apprentices have a shop instructor who spends his entire time instructing apprentices, and who sees that job changes are made as scheduled. The schedule for the machinist apprentices is illustrated. By keeping these cards filled out it can be determined at all times exactly where each boy is and on which jobs he has served to date.

The classroom is open during the noon-hour period to all apprentices. Reading matter is provided in the form of mechanical periodicals, and the small but complete mechanical library is available at all times. At the noon-hour meetings any subject of interest that any boy may suggest is considered and discussed. The boys are not compelled to attend the noon meetings but the apprentice room is always well occupied during that time.

The equipment consists of an inexpensive set of tables and stools, a home-made blackboard and a sufficient number of drawing instruments and their accessories to accommodate a full class. Drawing materials are furnished by the company. Several charts showing mechanical sections of such pieces as lubricators and injectors have been acumulated, and these are supplemented by sectional models.

A feature we particularly stress is that of teaching apprentices the cost of materials and various pieces of equipment used in connection with locomotive repairs. At each meeting a specific cost is issued on a repair part

or on some type of material. The boys are expected to remember this cost approximately. Reviews of costs are held each evening for about a ten-minute period. The purpose of this instruction is to enable apprentices at any time to make an intelligent estimate of a repair job. Examinations are held once a month on the subjects discussed during this period.

One fourth of the class time is taken up with written examinations. Experience has shown that where examinations are not held and the apprentice school is run in mere lecture form, certain boys will make no undue effort to memorize what is taught to them. The examination papers are graded on the basis of *A*, *B*, *C*, *D*, and *E*. A boy who gets *E* in his examination more than twice in succession is removed from service. We have not, however, had to remove any boy directly for this cause.

The shop work of apprentices is graded on the following basis. Marks are made out by the shop instructor in the machine shop in conjunction with the foreman. Quality, quantity, neatness, obedience, promptness, steadiness and initiative, are taken into account. At the end of each six-month period, the three students with the best records are given a reward in the form of a trip to some important city and are conducted through one of its interesting manufacturing establishments, after which they are given some social reward.

Subjects Taught

The subjects taught in the apprentice school begin with arithmetic through fractions, decimals, ratio and percentage. A working knowledge of plain and solid geometry, trigonometry and elementary algebra is also given. Such subjects as shop sketching, and the reading of working and mechanical drawings, are included in the last two years of the apprentice course.

Apprentice instruction sheets are issued at intervals. These sheets deal with subjects that have been taken up in the classes, and form a valuable set of notes which each apprentice will have accumulated upon his graduation. For instance, taking up the subject of "Cancellation," such practical applications as the speed of pulleys, horse power, the strength of boiler shells, and tractive effort are thoroughly covered, the formulas being analyzed and apprentice instruction sheets issued accordingly.

The classroom meetings are supplemented about once a month by a lecture from some railroad official or supply-company specialist. For instance, the general road foreman of engines at one meeting gave a talk on front ends; the mechanical engineer explained at another meeting the meaning of Wabash specification numbers of material; the chief draftsman lectured on the relation between the drawing room and the shop; and on several occasions supply men have described their various specialties.

In apprentice training nothing can take the place of personal contact. The apprentice supervisor is in constant touch with the boys at all times and is called upon to act as personal advisor to them in their home life. He receives all of their communications in confidence and has been able on a good many occasions to give assistance and advice.

Try to Absorb Graduates

The apprentice department endeavors to keep its graduates in touch with outside positions in the event there are no vacancies in our own organization. We try, however, to absorb our own graduates to as great an extent as possible. An apprentice club for the social welfare of the apprentices has been established and once a month an entertainment of some sort is given either in the form of a dance, a smoker or a banquet. The boys pay a nominal sum per month as dues which in turn finances the club. A baseball team is sponsored by the club, all members of the team being required to be apprentices.

After more than a year of operation, we find that we have aroused in the boys an unexpected interest. In addition, the training system has attracted as applicants a higher grade of prospective mechanics. The wholehearted co-operation from the officials of every department and also from the various shop crafts association heads has aided satisfactory progress. The apprentice school at present is small as compared to many of the larger and elaborately equipped schools, yet a steady growth is anticipated.

On the Design and Maintenance of Production Equipment

PRODUCTION equipment, with particular emphasis on machine tools, gets a lot of attention next week. From the design angle we get the story of the basic principles underlying a milling machine that can assume over 2,000 different final forms, and from standardized units. Here is an arresting answer to the special-machine question. From the operation side there is an account of the steps taken by an average shop, not a high-production shop, to find out just how it stood on obsolete equipment, department by department. The tables of machines from each department provide excellent samples against which any works manager or superintendent can check the percentage of obsolescent machines in his own particular bailiwick.

· BOOK · REVIEWS ·

THE AMERICAN WAY TO PROSPERITY. By Gifford K. Simonds, general manager, Simonds Saw and Steel Company, and John G. Thompson, assistant to the president of the same company. Two hundred forty-nine pages, 6x9 in. Cloth board covers. Indexed. Published by A. W. Shaw Company, Chicago, Ill. Price $3.

IN THIS book two executives in an outstanding industry have summed up the practical economics of American business in a masterly way. The 27-page introduction, alone, stands out as a clear exposition of the fundamentals on which the average American earns his living and builds up his business, with consideration for those qualities of education, character, and knowledge that are now regarded as essentials for success in the community.

There are nine chapters in the book, covering the high points of the important subject of production, distribution, research, forecasting, budgeting, organization, personnel, and social control of industry. The last two chapters, particularly, are timely essays on subjects that are uppermost in industry today.

The authors have succeeded in giving the internal story of industry in broad outline, with enough of the detail to make it conclusive. Eighteen tables and numerous charts have been included to give a picture of the condition and progress of various phases of the economic situation. Some selected business cartoons are also used. The book is for all those who want to get a clear idea of what modern industry in the United States offers to the worker and to the leader.

PRINCIPLES OF SCIENTIFIC PURCHASING. By Norman F. Harriman. Three hundred one pages, in cloth board covers. Indexed. Published by the McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York, N. Y. Price $3.

THIS book is one of the McGraw-Hill industrial management series. It is written by a man who has had a wide experience in handling purchasing problems as a member of the Federal Purchasing Board and the Federal Specifications Board, and it constitutes a very comprehensive analysis of the aims and duties of the purchasing agent.

The first chapter is devoted to the "evolution of merchandising and the market," and gives a rapid word picture of the purchasing function in business. This is then followed by a chapter on the place of importance which purchasing has now assumed in modern industry. Other aspects of purchasing, such as the financial, psychological, and legal, are discussed in separate chapters. Other matters treated, which are of importance to the purchasing agent, are: Standards, specifications, control of quality, budgetary control, procedure and purchasing organization. A description of the purchasing organizations of a large manufacturing company, a typical railroad, and of the United States Navy are included in the appendix. The book is thorough and concise, and should be of interest to purchasing agents or manufacturers who are interested in bettering the operation of their purchasing departments.

HANDBOOK ENCYCLOPEDIA OF ENGINEERING. Franklin D. Jones, Editor. Twelve hundred forty-two pages, 4½x7 in. Published by The Industrial Press, New York. Price $6.

COVERING in condensed form the same general field as the seven-volume encyclopedia by the same publisher, this handbook is for those who prefer a more compact work for reference use. It consists largely of condensed items and treatises, and definitions of words, expressions and trade names used in engineering and in the shop, given in non-technical form. The following titles selected at random give an idea of the type of subjects covered: abscissa, acetylene, air-hardening steel, back-gears, boiling point, circuit-breakers, feed-mechanisms, globe valve, grinding wheel care, relieving attachments, safe load and size of springs, stainless steel, wage systems, and zinc. About 4,100 definitions are given.

LECTURES ON STEEL AND ITS TREATMENT. By John F. Keller, Engineering Extension Division, Purdue University. Two hundred and sixty-seven 9x6-in. pages, and one hundred and sixty-six tables. Published by the Evangelical Press, 1,900 Superior Ave., Cleveland, Ohio. Price $3.50.

FOR several years the author has been giving the six lectures contained in this volume to industrial groups throughout Indiana, as a part of the extension services of Purdue University. His experience, from early beginnings as a blacksmith and later as an instructor, is crystalized in these pages in a simple, clear and convincing style, which permits the reader to grasp readily the principles involved in the handling of iron and steel, when manufacturing tools and machinery. The book is not highly scientific in tone, but is written to give the non-technical man a good picture of the subject with a reasonable amount of effort.

Interest in the subject is aroused in Lecture I by the résumé of the probable beginnings of iron manufacture in very early times. He then proceeds to describe blast furnace operation, puddling, and the steel making processes, together with the subsequent treatment of steel ingots. Mechanical working of iron and steel is taken up in Lecture II. The third lecture is devoted to the structural changes on slow cooling, the micro-constituents of steel, annealing, strength of metal at elevated temperatures, and normalizing. Determination of critical points and physical testing is described in the fourth lecture. The processes of hardening, quenching, tempering and carburizing, with particular reference to alloy steels, are commented upon in the fifth lecture, while warpage, cracking and shrinkage of steel is discussed in the last.

A.S.T.M. TENTATIVE STANDARDS, 1928. Nine hundred thirty-two pages, 6x9 in. Published by the American Society for Testing Materials, Philadelphia, Pa. Price $7 in paper, and $8 in cloth binding.

ONE hundred eighty-five tentative standards are printed in the 1928 volume with a view of eliciting criticism before adoption as standards. Among the 39 relating to metals, is one on cold-rolled strip steel which proposes five grades of commercial strip steel for blanking, bending, forming, spinning and deep drawing; also one on aluminum sheet. A tentative recommended practice covers the radiographic testing of metal castings. Tentative revisions are given of several of the previously adopted standards, such as those on gray-iron and high-test gray-iron castings, and free-cutting brass rod for use in screw machines.

· TECHNICAL · ABSTRACTS ·

The Nine "Spark Plugs" of Labor Management

My experience has taught me to term as "spark plugs" the contacts between management and labor that must be set free from maladjustment if man power is to be properly generated. The first "spark plug" is the question of wages. Upon this point the employer and employee are in continual conflict. The worker to-day states that he must meet the economic pressure of living, and along with it he demands a better status in life with constantly increasing standards of living. While high wages are a factor of high prices, labor is correct when it observes that they are not the sole factor and frequently not a major factor when compared with the other items of cost in production and distribution.

Often the problem of wages centers around the related question of productivity. The worker usually states that he is willing to produce when accorded every possible safeguard. But he frequently objects to piecework or bonus systems, the statements being made that the worker is speeded up too much, that he overproduces and thus works himself out of a job, or that the wage rate will be cut after a high wage level has been reached. Usually a clear explanation of the method of determining wages, together with representation on an arbitration board will secure full co-operation.

A steady job is just as important to the worker as the right wage. Elimination or lessening of the insecurity of work is an important feature in building up the morale of the working force, and in maintaining a co-operative attitude on the part of the worker. Careful plans should be made to mitigate the evil effects of the sudden introduction of labor-saving machinery and methods in order to preserve the morale of the organization.

Proper hours and healthful conditions of work are important to both the worker and the employer for they condition labor's productive effort as well as the worker's personal well being. The question of how many hours per day and how many days per week must be worked is a problem to be determined by the individual plant while considering its own special conditions, both physiological and psychological factors entering therein.

Another most important "spark plug" is getting the right worker in the right job. Before getting workers for a job it is necessary to know what the job really is. Too often the job is not thoroughly understood. To know it requires the working out of job analyses which form one of the guide posts of managerial actions as they give the standards of the job. After a worker is hired, follow-up and training are essential.

Skill, as reflected in quality of work, is just as important as productivity, and apt to be more so in maintaining the market for the production of a plant. Craftsmanship, however, embraces more than just skill. It brings pride of the worker in his work. It is an intangible thing and should be prized most highly.

The last three "spark plugs" have to do particularly with personnel work. Plans for handling various problems of a general nature such as special benefits through the co-operation of employer and workers furnish a basis for good will. A selfishly inspired or badly conceived benefit plan will involve a great deal of trouble. Co-operation between employer and employee to stimulate and maintain cordial relations and adjust the differences when they arise is a phase of labor management that often makes or breaks other relations. Various types of works or shop committees and of collective bargaining with purely workers' organizations have been employed to secure the result of co-operation. Finally, there is the "spark plug" of company consciousness. This means not only an attitude on the part of labor that makes it interest itself in the success of the employer, but also an attitude on the part of the employer that makes him consider, as man to man, the well-being of the worker. If such a frame of mind is present, other matters are secondary, although they require intelligent action in their respective spheres.—D. L. HOOPINGARNER, *Magazine of Business*, December.

Incentives Cut Handling Costs

On industrial trucking work at the Pittsburgh plant of the Westinghouse Electric & Manufacturing Co., an incentive wage plan cuts costs from 9 to 50 per cent. This type of handling work is controlled through four industrial truck dispatch stations which supply service to all points. Each station operates from nine to twelve trucks, which are supervised by the dispatcher or station clerk. Requests for handling are turned into the station usually by phone where they are recorded on a small dispatch tag. On this tag are noted the points between which the material is to be transferred and the time when the request was made. Later, the truck making this delivery is noted and also the time it takes. This plan gives a close check on the operation of each individual trucker.

Each delivery up to the maximum of one truck load is the unit for measuring the work performed. It was found that hoist trucks could make far more trips than flat trucks so separate time limits were set for each. The following formula was derived for computing the earnings of one group.

$$\text{Time allowed} = [(0.460 \times F) + (0.317 \times H) - T]\ 0.25 + T$$

Where:

0.460 = Time allowed per delivery for flat truck

0.317 = Time allowed per delivery for hoist truck

F = Number deliveries made by flat truck

H = Number deliveries made by hoist truck

T = Time taken

Although parcel delivery truckers are handling considerably more work than usually set as the "make out" point, they seem to be capable of handling still more work. A reduction of approximately 28 per cent has been made in labor and the car movement has remained about 550 shifts per day. In one case, although the work increased 12 per cent, a reduction of 9 per cent in labor cost was effected. The group collecting refuse at night gave a reduction in labor expense of slightly over 50 per cent. With the present number of 41 men employed, a total saving of $1,555 a month has been attained—*Manufacturing Industries*, November.

Germany Develops Chromium Plating

Plating with chromium has not met with great success in Germany, as it is claimed that the plating chips too easily when the steel is undergoing a severe test or is used as a cutting material. It has been found impossible to determine that all parts of the material being plated will receive a uniform coating of about 100 mm. Microscopic tests are said to have proved that the plating on steel varies from 1/80 to 1/150 mm. It is also claimed that chromium suffers decidedly from fatigue, especially when it is plated on steel in constant and regular use.

Experimentation is understood to show that copper and brass, plated with chromium, do not develop the unsatisfactory defects of steel. The thickness of the plate has been found to range from 1/95 to 1/105 mm., and does not chip. Steel first coated with a thin plating of copper or cadmium, and followed by chromium plating has been found to meet as severe tests as nonferrous metals. This treatment, however, increases the cost of production. It has also been found that a variety of colors of the chromium plating is obtainable by changing the electric current in the bath. Milky, gray, bright, or dull-silver plating has been developed, and an effort is being made to produce both red and gold tints by this method—*The Iron Age*, Nov. 22.

IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Repairing a Drill-Press Base by Welding—*Discussion*

By R. E. Marks

If, as stated by George W. Meade in an article under the title given above, on page 747, Vol. 69, of the *American Machinist*, gray iron is brittle and has a tendency to break, why do we continue to use it for bases of drill presses and similar machines? The broken base shown by Mr. Meade is a sad commentary on either the designer or the material. Why not make the base of steel shapes, plate welded in the first place, instead of waiting for it to break.

If T-slots are necessary, they can be secured by welding on wide-flanged I-beams. If weight is necessary, fill the base with concrete; even lead would be cheaper than to have to weld up a broken base and keep a busy machine out of service.

Welding a Locomotive Cylinder

By Chester H. Franklin

One of the most powerful locomotives on the Canadian National Railways met with a mishap, in which the front end of the steam chest and part of the passage pipe through which it receives steam from the boiler, were broken off. The result of the break is shown in Fig. 1 trimmed up preparatory to welding on a new front end.

A suitable pattern was made and a new front end, weighing 550 lb., was cast. The casting was placed in position and held firmly for welding. The result is shown in Fig. 2 after the new piece has been welded and machined. Tobin bronze was used in making this weld, 185 lb. of bronze welding rod being necessary to complete the operation.

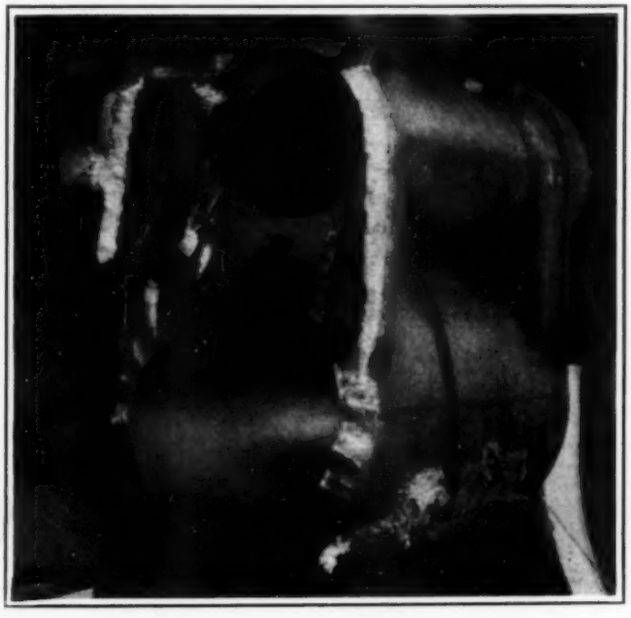


Fig. 1—Front end of steam chest broken away

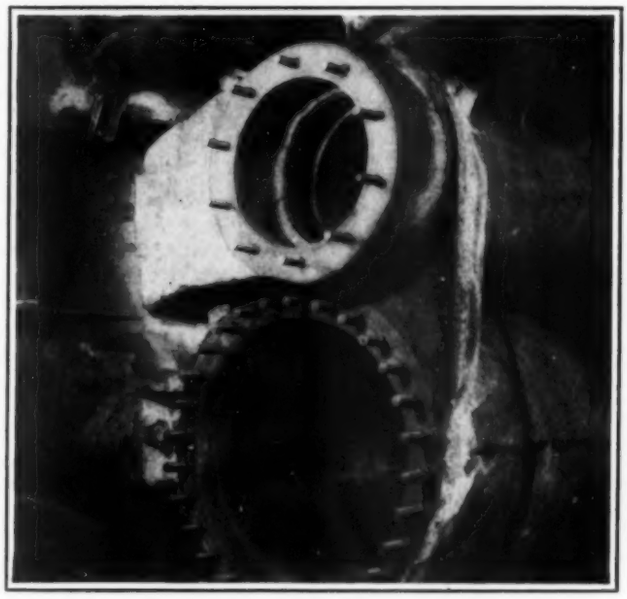


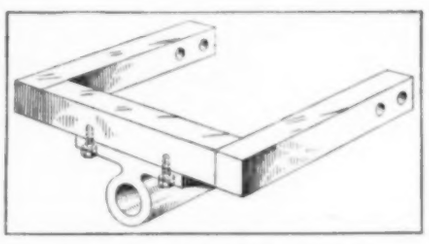
Fig. 2—New casting welded in place with Tobin bronze

The locomotive is now in regular service and the cost of the repair showed a very satisfactory saving over the cost of replacing the entire half-saddle casting. In addition to the saving in cost, the locomotive was out of service but a comparatively short time.

A Splining Tool for the Shaper *Discussion*

By Charles Kugler

I have used all the methods described in articles under the title given above that have been published in late numbers of the *American Machinist*, and have found the following objection to them: When taking a heavy cut the bar would spring, causing the tool to dig in and often to break. To obviate this difficulty, I designed the sup-



Support for splining bar

port shown in the illustration. It is made of three pieces of 1-in. square steel. The side pieces are screwed and doweled to the sides of the shaper, while the front piece carries an outer bearing for the splining bar. The inner end of the splining bar is held in the clapper by any convenient method.

The work is fed to the tool by raising the table, because the splining bar cannot be raised or lowered, since its outer support is attached to the shaper column.

All the methods described by your contributors for holding splining bars, can be used in conjunction with the support described.

A Drill Jig and a Boring Fixture

By Herman F. Fiedler

We had an order for a large quantity of friction clamps like the ones shown in Fig. 1. Since breakage or wear would make it necessary to replace one or both parts, they must be interchangeable.

The first operation is to mill the sides *A* and *B*, and the face *C*. For drilling, the halves are placed in the jig shown in Fig. 2, where they are located by stops *D*, *E*, and *H*, being held by the screws *J* and *K*, and the clamp *L*. The sides of the jig have been machined at the proper angle for drilling the radial holes through the sides of the clamps.

After being drilled, the halves are placed in the boring fixture shown in Fig. 3, being located by studs *M* and *N* and stop *O*. They are held in place by the screw *P* and the clamp *S*. The fixture is mounted on the faceplate of a lathe and is trued by indicating the central hole.

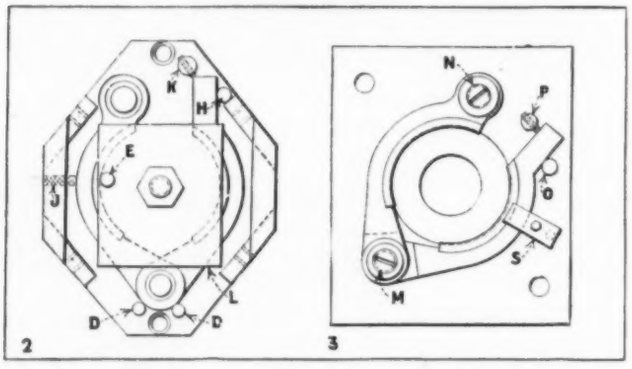


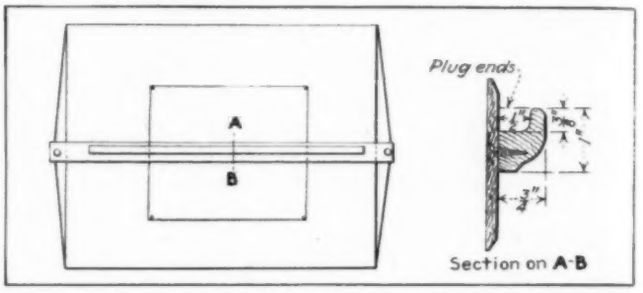
Fig. 2—The drilling jig. Fig. 3—The boring fixture

A Ledge for the T-Square

By H. S. Steele

The illustration shows a convenient attachment for the T-square or the parallel ruler. When attached to the T-square it forms a trough-shaped ledge, and is very convenient for holding pencils, instruments and erasers. The openings at the ends are plugged, so that anything laid in it can not slide out endwise.

No matter how much the drawing board is tilted, nothing placed in the trough of the ledge can roll out of it. With drawing implements kept in the trough, they are at hand when the draftsman wants them, so that he does not have to reach for them as the T-square is moved up or down on the board.



A convenient attachment for the T-square

Welded Guards for Machines

By John H. Stewart

The machine guard shown in the illustration was put together by welding with an oxyacetylene torch.

With standard angles, some bar stock, wire screen, and a little ingenuity, guards of almost any size or shape can be built up at a small cost. The one here shown was made by a welder in a steel mill in the middle West in his spare time.

The angles forming the edges were bent to shape and welded at the ends. They were then held in place by bolts, so as to permit rapid assembly. The screen wire was attached to the angles by welding with bronze electrodes, after which the pieces for attaching the guard to the machine were welded in place.

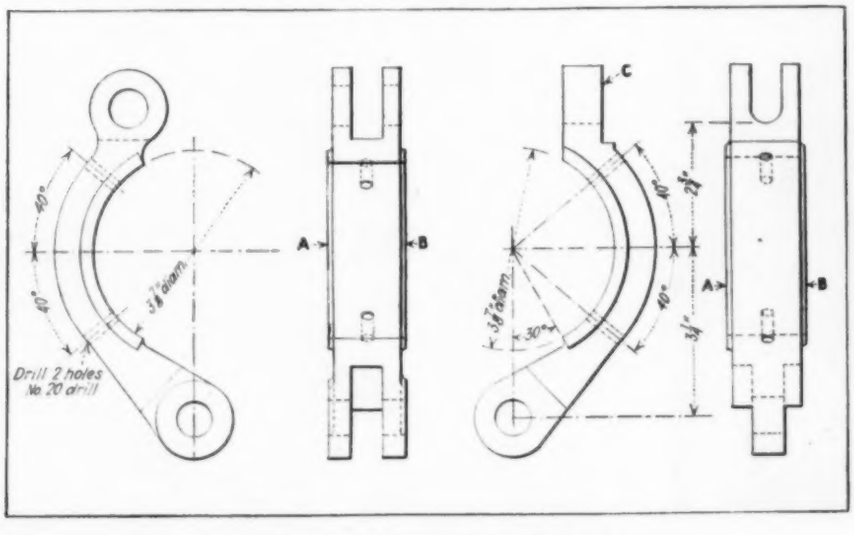
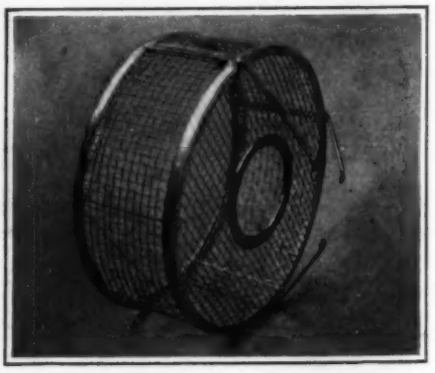


Fig. 1—Members of the clamps



A guard built up by welding

Materials for Machinery Finishing

Paint

A general name to designate a solution of pigment in water, oil, or organic solvent, and used to cover wood or metal articles either for protection or for appearance. Paints always contain pigments, and the solutions of gums or resins, known as varnishes, are not paints, although their application is usually termed "painting." Enamels and lacquers, in the general sense, are under the classification of paints, but specifically the true paints do not contain gums or resins.

The bulk of paint is made with about 65 per cent by weight of pigment and 35 of vehicle. The best paint for outside work consists of high-grade pigment and linseed oil, with a small percentage of turpentine as a thinner, and a drier. But paints are marketed in an infinite variety of grades, containing pigments adulterated with silica, talc, barytes, gypsum, or other material; fish oils, or inferior semi-drying oils in place of linseed oil; and mineral oils in place of turpentine. Metal paints contain basic pigments such as red lead, ground in linseed oil. Bituminous paints are of coal-tar or asphalt products, dissolved in mineral spirits, and used for the protection of pipes, and for waterproofing cement. Water paints consist of gypsum or whiting with zinc oxide, lithopone, or other material. They are moderate in price, but not durable. Luminous paints are made with radium, mesothorium, or with sulphurated lime.

Lacquer

Originally the name for a kind of Oriental finish made with certain slow-drying varnishes, but now referring to the quick-drying finishes made from nitro-cellulose, or "pyroxylin," or from cellulose acetate resins. The modern lacquers of this kind are widely used for finishing automobiles and other articles. They consist of the pyroxylin or other resin, one or more gums, a pigment, a softener, and one or more volatile solvents. Various kinds of gums are used for increasing the body, and giving hardness and gloss to the finished surface. For high gloss and hardness, dammar is used. For a cheaper product elemi may be employed. Kauri is used where good wearing qualities are required. The usual solvents are anhydrous alcohol, ethyl acetate, butyl acetate, butenol, benzol, and toluol. Softeners are such products as amyl, ethyl, and butyl phthalates.

Quick drying is the chief advantage of the lacquers, but the time must be made long enough to prevent the cloudiness coming from absorption of moisture from cooling by the rapidity of drying. For industrial work, lacquers are usually sprayed, and they dry in about fifteen minutes. Brushing lacquers are made slower in drying to prevent streaks and lumps in their application. The time of drying is controlled by arrangement of the solvents. The word lacquer is also used to describe a highly transparent varnish used to produce a thin protective film on polished or plated metals to preserve their luster.

Enamel

A protective coating or paint which, upon hardening, has an enamelled, or glossy face. Ordinary pottery enamels are chiefly composed of quartz, feldspar, clay, soda, and borax, with saltpeter or potash sometimes used as fluxes. The quartz supplies the silica. Such enamels are fusible glasses made opaque by a substance such as oxide of tin for white enamel, and cobalt oxide for blue. Platinum oxide is used to produce gray in enamels, and other substances give varying characteristics. In acid-resisting enamels, alkali-earth silicates are used instead of borates. Enamels applied to ironware are fired at a red heat. The enamels vary greatly, and, for application to a metal article, an enamel must have approximately the same co-efficient of expansion to avoid cracking. "White glass enamel" is easily fusible and is used for gage and clock dials and for scales. The word enamel in the paint industry refers to paints of ground oxides or sulphates mixed with varnish to give the glossy face. These are applied in the same way as ordinary paints, but they do not have the heavy body of a paint, and require an undercoat or several coats of the enamel.

Varnish

A solution of a resin or drying oil, which, when spread out in a thin film, dries and hardens by evaporation of the volatile solvent, or by the oxidation of the oil, or both. A smooth, glossy coating is left on the surface. Varnishes do not contain pigments, and when mixed with pigments, they become enamels. The most commonly used resin is ordinary rosin, and the most common drying oils are linseed and tung oils. Spirit varnishes are those in which a volatile liquid, such as alcohol or ether, is used as a solvent for the resin or oil. They dry by the evaporation of the solvent. Oleo-resinous varnishes are those in which the resin is compounded with an oxidizable oil, such as linseed oil.

The gums used in varnish, such as copal, dammar, and kauri, produce hardness and gloss in the film. The oils, such as tung and linseed, make varnish elastic and durable. Other important ingredients of varnishes are driers, such as manganese oxide, to hasten the action of the drying oil, and thinning agents, or "reducers," such as turpentine, naphtha, and benzol. Hydrated lime is added to varnishes to neutralize the acid in the resin; and to clarify and harden the varnish to prevent it from becoming sticky in warm weather. Spar varnishes are those made to withstand weather conditions. "Gloss oil" is a solution or rosin in benzine, and is of inferior grade. "Long" varnishes are those that contain more oil than the "short" varnishes, and they are more durable. Varnish is employed usually as a finish for fancy wood surfaces, but is also used as a protection against moisture on wood, paper, fiber, and other materials.

Japan

A name applied to black baking enamels. The same finish in other colors would not be called japan. Japan consists essentially of a pigment, a gum, a drying oil, and a reducer for ease of application. It is always baked, the usual temperature being about 375 deg. F. The general process is to drive off the solvent and fuse the gum until it is in a uniform vitreous layer. In some cases flame baking is used to burn off the solvent, and to oxidize the drying oil. Japans are used for giving a tough durable finish to machine parts, especially to such machines as the typewriter. Several coats are usually applied, the surface being carefully rubbed and polished between coats.

From a forthcoming Materials Handbook by George S. Brady, Associate Editor, *American Machinist*

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Renaming Overhead

OVERHEAD seems to have been with us ever since man began to make things to sell and had to keep some sort of an account of his expenses. In some cases everything outside of labor and material is charged to the overhead account, with little, if any, attempt at classification. If any money is left over after all bills are paid it is too often called profit.

Modern concerns segregate most of the expenses beyond labor and material and apportion them where they belong—such items as insurance, taxes, depreciation and others. In too many cases, however, the account called overhead acts as a kind of waste basket into which all sorts of expenses are dumped with but little attempt at analysis. And when the percentage of overhead goes up, as it does when labor costs are reduced, the manager is scared into trying to reduce it, frequently by cutting out the wrong item.

One school of accounting advocates eliminating the term "overhead" altogether. It proposes segregating all expenses under their respective heads so that each can be studied and reduced if possible. This method it is believed will tend to prevent unwise curtailment of some expenditures just because they fall under "overhead" at present, and show the items that can best be examined critically.

The term "overhead" has too long been a bugaboo that frightens us because we do not give sufficient study to each one of the individual items that go to make it up.

The New Cutting Metals

REACTIONS to the advent of the new cutting materials vary widely. One man sees the obsolescence of all present metal cutting equipment and its replacement by super-machines that can utilize the latent possibilities of the new cutting tools. Another points out the fact that there are still in use thousands of machines too old to use even high-speed steel efficiently. Between these extremes is the man who is sure that if present equipment were used efficiently, production could be greatly increased. All three views are probably necessary—the first to spur designers to dreaming and drawing better machines, the second to spur sales departments to renewed effort, and the third to stir up production men to a better utilization of the equipment under their care.

But, no matter how backward some may be in adopting new ideas, the progressive users will demand machines that will permit them to profit by the increased speeds made possible by the new cutting materials. It is not safe to feel that present machines are good enough, even if they seem to satisfy the majority of users at present. Such fancied security is akin to resting on past laurels and will be rudely shaken when higher speeds become realities in the not very distant future.

Progress or Prejudice

"NO MACHINE with a cast gear comes into my plant," announced a machine buyer who calls himself Progressive, with a capital P, in declining to place an order for a machine that had met all his other requirements. And this in spite of the fact that hundreds of similar machines were giving good satisfaction elsewhere, in spite of the builder's offer to give him the machine if one of the cast gears broke in service. Clearly a case where an assumed spirit of progress was really a prejudice due to ignorance.

In this particular case gears were amply strong. Tests had shown that enough power could be put through them to bend the teeth of the steel feed rack and that no tool could stand up under the strain. But the buyer's prejudice against cast gears, and his idea that steel gears always meant progress, lost money for both the builder and the user of the machine.

The real question is, should the buyer buy specified details of construction or performance? Should the builder add to the cost of his product both for himself and for the user, to satisfy an unreasonable and prejudiced demand for steel gears or other details?

The answer probably depends on the proportion of customers who demand steel gears regardless of the necessity for their use. For in the end the customer gets what he wants—and pays for it. Economy would seem to suggest that the customer consider the builder's designs seriously before demanding changes that mean more expense without corresponding benefit. In other words, be sure that fancied progress is not, in reality, prejudice.

· SHOP · EQUIPMENT · NEWS ·

Diamond Type H, Plain-Head, Surface Grinding Machine

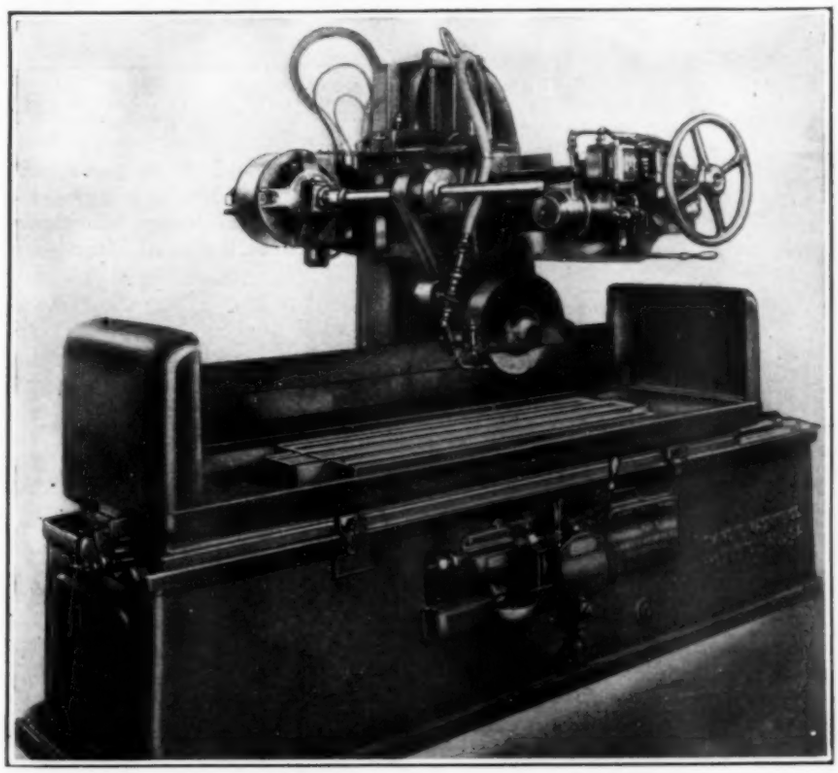
MASSIVE construction is the feature of the Type H, plain head, surface grinding machine that has been developed by the Diamond Machine Company, Providence, R. I. The machine illustrated is available in two standard sizes to handle work 48x16x16 in. and 72x16x16 in., respectively, and extra-size machines of the same design can be furnished. The grinder is designed so that the bed and table are independent of the head upright and crossrail. Tests have shown that a fast table speed can be maintained under a 1,700-lb. table load.

The bed casting is of nickel cast iron and the column is internally braced for added rigidity. Ball bearings are used wherever possible. Broad ways are featured. The total table travel in the smaller size is 60 in., while that for the larger is 84 in. A wide range of feeds is available through the oil-driven mechanism controlled through the by-pass valve.

The work is ground by means of a 12-in. wheel having a 1½-in. face and a 1½-in. hole. The spindle speed is 1,500 r.p.m. Cross feeds are 0.025, 0.050, and 0.100, or 0.200 in. per stroke, and the rapid traverse is 17.75 in. per min. Vertical feeds are 0.125, 0.25, 0.50, or 0.100 in. per stroke, and the rapid traverse is 8.80 in. per min. Power, cross, and elevating feeds cannot be engaged at the same time. A hand feed is provided for both the cross and vertical feeds. The table has a convenient height for loading and unloading, and has cast-aluminum end guards.

Three motors are used on the machine. The spindle motor is rated at 5 hp., and runs at 1,800 r.p.m. on either a.c. or d.c. The oil pump is driven by a 2-hp. motor, at 900 r.p.m,. on either a.c. or d.c., while the coolant pump of ¼ hp. is suitable for single-phase, 60 cycle, 110-volt circuits only. A coolant supply tank having 40 gal. capacity is cast integral with the bed, and a separate 7-gal. sediment tank is located conveniently. It is removable. The coolant pump is direct-connected, and is of the vertical-spindle type.

The floor space required is 154 or 202 in. long by 83 in. deep. The height from the floor to the table is 30 in., and from the floor to the top of the vertical screw of the head upright is 82 in. Shipping weight is 8,500 lb. for the 48-in. machine, and 9,500 lb. for the 72-in. machine.



Diamond Type H, Plain-Head, Surface Grinding Machine

"Radiac" No. 1 Cut-Off Machine

Designed for the cutting of tubing, bar, round or flat stock of cold-rolled steel, hardened steel, and various alloys, this "Radiac" No. 1 cut-off machine has been placed on the market by A. P. DeSanno & Son, 1,615 McKean St., Philadelphia, Pa. According to the manufacturer, solid stock up to 1 in. in diam. is cut so quickly that the heat generated is not sufficient to draw the carbon or temper. The abrasive wheel spindle operates at 5,000 r.p.m. so that the 12-in. wheel travels at a speed of 15,700 surface ft. per min. The spindle is mounted in self-aligning ball bearings, and is operated on a

"Radiac" No. 1 Cut-off Machine

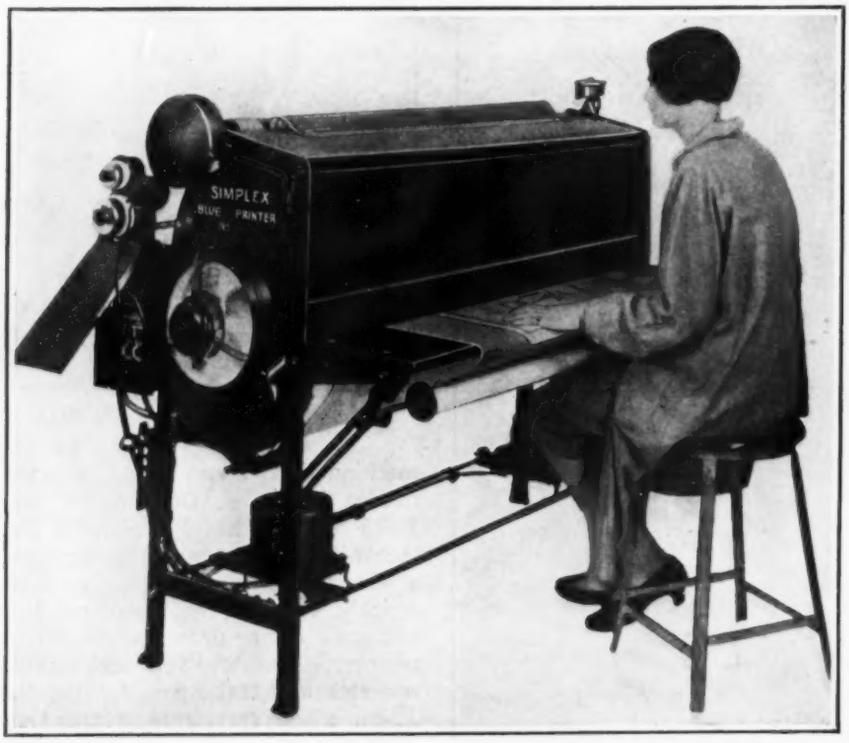
sliding head so that the wheel is drawn to the material to be cut.

Work is held in a V-shaped slot by means of a quick-acting, foot-operated clamp. This feature increases production in cutting bars to stock lengths as the right hand is used to operate the wheel, the left for feeding the work, and the pedal for clamping and releasing the material. A special Radiac cut-off wheel has been developed for use on this machine. It is 12 in. in diam. by $\frac{3}{32}$ in. thick. A motor of $7\frac{1}{2}$ hp. is required. The height of the machine is 46 in., and the floor space required is 15x24 in. The weight is 320 lb. net.

Shaw Horizontal, Continuous Blueprinting Machine

Production of 850 sq.ft. of blueprints per hour can be obtained on this horizontal, continuous-type blueprinting machine, according to the Shaw Blue Print Machine Company, Inc., 9 Campbell St., Newark, N. J. The machine consists of a half-cylinder of plate glass mounted in cradles on end castings, around which passes an endless canvas band. A flaming arc lamp suspended from a steel groove operates back and forth across the machine. A motor mounted in the frame furnishes power for driving, through friction disks, the endless canvas band and lamp, their movements being synchronized from one drive shaft. A numbered dial at the top and right-hand side of the machine gives the operator sixteen speed changes of from 4 in. to 4 ft. per min., so that a wide variety of tracings and prints can be handled.

Prints up to 42 in. in width by any desired length can be made on this machine. Tracings and sensitized paper, either from a continuous roll or pre-cut to size, are fed into the front of the machine from the feeding table. The tracings are returned to the operator at the top, while the prints go to the receiving table at the rear of the machine. Prints, negatives, blue and brown lines, and "Ozalid" prints may be made.



Compactness and easy operation are features of the Shaw Horizontal Continuous Blueprinting Machine

Oxweld Cap- and Skeleton-Type Helmet Goggles

Two types of helmet goggles have been added to the line manufactured by the Oxweld Acetylene Company, 30 East 42d St., New York, N. Y.

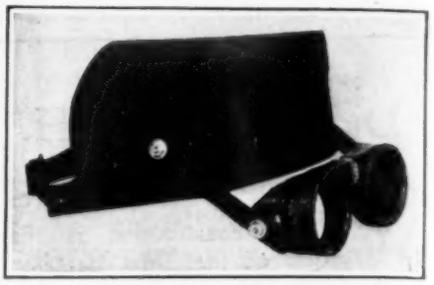


Fig. 1—Oxweld No. 9 Cap-Type Goggles

The No. 9 cap-type goggle shown in Fig. 1 consists essentially of a strong fiber cap to which a pair of goggles is attached by means of fiber links. The goggles can be readily arranged over the forehead or lowered over the eyes with one hand. The bridge is adjustable, and is covered with rubber insulation. Replaceable lenses in

Fig. 2—Oxweld No. 10 Skeleton-Type Goggles

the same size and colors as supplied in the Oxweld No. 6 goggles are used, the colored lenses being protected by cover lenses of clear glass. The No. 10 skeleton-type goggles, illustrated in Fig. 2, are the same as the No. 9 goggles, except that the goggles are attached to a leather skeleton cap. Both types are provided with leather straps at the rear for head-size adjustment.

Black & Decker "De Luxe" Engine Kit

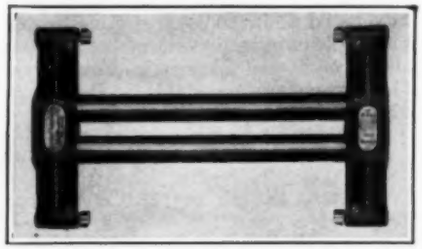
A convenient metal chest containing a $\frac{1}{4}$-in., heavy-duty, ball-bearing electric drill and complete with valve and carbon tools to fit nearly every car or truck, has been placed on the market by the Black & Decker Manufacturing Company, Towson, Md. Necessary equipment is included to

Black & Decker "De Luxe" Engine Kit

ream narrow valve seats as well as valve seating stones to finish grind the same parts. Two sizes of valve testers are also part of the equipment, their purpose being to subject each valve and seat to a compressed air test when ascertaining the trueness of the work. Wire brushes may be driven by the ¼-in. drill to clean cylinder heads, tops of pistons, valves and valve guides.

"Standard" Adjustable-Limit Pin Gage

The accompanying illustration shows the adjustable-limit pin gage patented and marketed by the Standard Gage Company, Inc., Poughkeepsie, N. Y. This gage incorporates the "go" and "no go" feature in one gage by means of adjustable



"Standard" Adjustable-Limit Pin Gage

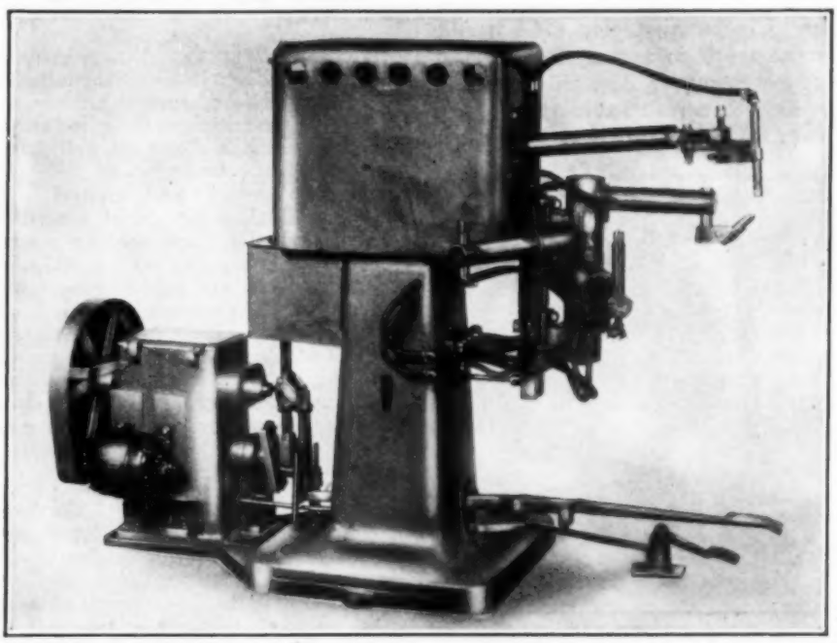
gaging pins mounted in the head, each of which gives a predetermined dimension with the stationary pin. This construction eliminates dependence on the "feel" of the operator.

The pins are adjustable for wear, and for size within the range of the gage. They are held rigidly in the gage by a patented pin-locking device, insuring the same accuracy as with a solid gage. The gage measurement is taken from the fixed end of the gage radially to the pins, and, in checking internal measurements, the operator can gage rapidly within the tolerance limits by a single rocking motion of the gage. The regular sizes of the gage run from 4 to 24 in., but gages for larger internal diameters are made on order.

Thomson Special Model No. 176-C Spot Welder

Multiple tooling is the feature of the special Model 176-C spot welder, which has been developed by the Thomson Electric Welding Company, Lynn, Mass. The machine illustrated is designed especially for welding a box, and requires several different electrode combinations in order to reach all the corners. For this purpose, a multiple electrode holder is provided, which quickly swivels from one position to another so that all parts of the assembly can be reached without extra handling.

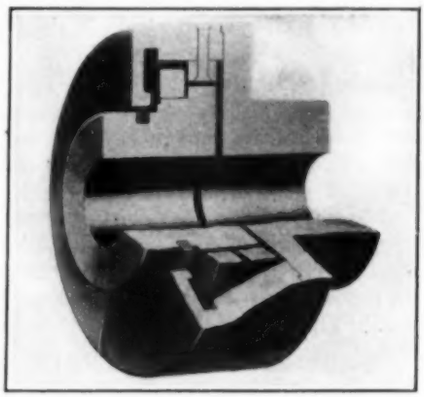
The machine is rated at 15 kw. and may be either foot or power operated. The power drive is through a six-speed gearbox, which is furnished for either belt or motor drive. The lower terminal post swivels to three positions and the horns and dies mounted in the posts are fully adjustable both horizontally and vertically. The upper die also swivels horizontally and may be adjusted vertically.



Thomson Special Model 176-C Spot Welder with Multiple Electrode Holder

"Flex-Ring" Type B Full-Floating Flexible Coupling

An all-metal coupling known as the type B "Flex-Ring" has been placed on the market by the T. L. Smith Company, Milwaukee, Wis. It is de-



"Flex-Ring" Style B Full-Floating Flexible Coupling

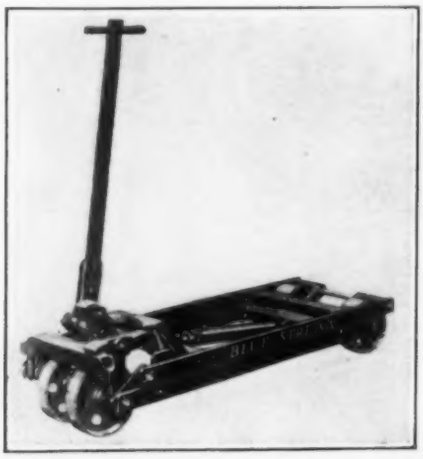
signed to take care of ordinary conditions encountered in a direct drive. As shown in the illustration, flexibility is obtained by means of two long ring-shaped springs having a large amount of deflection. Accord-

ing to the manufacturer, these springs permit end play of the motor shaft without any sliding action and smooth out the vibration in the drive. In addition, the Style B coupling is said to compensate for both angular and offset misalignment without causing excessive bearing loads.

All-metal working parts are used throughout. The hub, which is made of cast steel, has two projections machined to fit the gaps in the driving springs. It is also provided with a recess for a felt packing that retains the grease in the housing. The latter is made of semi-steel, machined all over. It carries two keys corresponding to the lugs in the hub. These keys are set into machined recesses in the housing, and are riveted into place. The flange is made of semi-steel, and is also machined all over. Heat-treated steel is used for the springs, which are machined to fit over the projections on the hub and the keys in the housing. The flange and housing are bolted together, and all inside parts are held in position without the use of flat rings or bolts.

Stuebing-Cowan "Blue Streak" Side-Lift Truck

Loads up to 2,500 lb. can be transported on the "Blue Streak" side-lift truck, which has been placed on the market by the Steubing-Cowan Company, Cincinnati, Ohio. The handle on the truck is arranged so that it may be swung 45 deg. either side of the axis to permit loading in limited space. A positive hydraulic check is provided, and the lift hook and pedal are drop forgings, which are independent in action. The positive lock and release pedal cannot become disengaged, except when tripped with the foot. Frame members are made from heavy steel bars. Hyatt roller bearings are provided.



Stuebing-Cowan "Blue Streak" Side-Lift Truck

Trade Publications

AUTOMATIC PUMPING. Barrett, Haentjens & Co., Hazleton, Pa., has published Bulletin No. 820, entitled, "Automatic Pumping with Vacuum Pump Primer." In this system, the centrifugal pump is located above the source of water supply, while a priming pump is used to exhaust the air from the centrifugal casing, thus preparing the unit for operation. A sketch is given showing the general arrangement of the equipment as well as electrical diagrams for the control mechanisms.

DIESEL ENGINES. The Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y., has published bulletin No. 774, covering the "CP" Diesel engine, Type RH 40. The engines are of the Benz make, having been acquired from the Benz interests in Germany. Horsepowers from 80 to 240 at 327 r.p.m. are available. The catalog gives a general description of the engines, together with the construction of various important parts. Cut-away views, dimension drawings, and illustrations of installations are given. The catalog contains twenty 11x8½-in. pages.

GENERAL ELECTRIC PUBLICATIONS. The General Electric Co., Schenectady, N. Y., has published several catalogs of interest to the metal-working industry. Bulletin No. 240A shows oil well drilling equipment consisting of 440-volt wound-rotor-motors and control apparatus. Catalog No. 569B describes constant-potential arc-welding sets. Bulletin 881A, superseding No. 881, describes the G.E. arc welder, gas-engine driven type. The current range is from 60 to 300 amp. Bulletin 1,072, superseding 68,032, shows an electric motor drive for cotton pickers, and Bulletin 1,073, superseding 68,029 shows an electric motor drive for cotton roving machinery. All catalogs are illustrated and some have specification tables.

SPEED REDUCERS. The Morrison Machine Co., 204 Van Houten St., Paterson, N. J., has published a catalog showing its speed reducing transmissions. Beginning with the development of these speed reducers, the catalog proceeds to describe the construction, illustrations being provided. Horsepower ratings for both series A and B are given, together with dimension diagrams. For the standard box type, ratios up to 729 to 1 are available, while for right-angle types, ratios up to 1,458 to 1 are obtainable. The catalog contains 22 6x10-in. pages.

STRAIGHT-LINE TRUCKING. The Stuebing-Cowan Co., Cincinnati, Ohio, has published a photogravure catalog entitled, "Straight-Line Trucking," which depicts equipment and methods for handling materials on skids between plants. The handling of many types of materials in and about the manufacturing plant, upon freight sidings and in freight cars is shown. Eight standard types of steel-bound platforms for transporting various materials are illustrated. The catalog contains sixteen 11x8½-in. pages.

TEXROPE DRIVES. The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has prepared Bulletin No. 1,228-H on Texrope drives, which are suitable for speed reductions from 1 to 1 up to 7 to 1. A list of machinery for which this drive is suitable is given, and the balance of the catalog consists of pictures of installations in many industries. The catalog contains fifteen, 11x8½-in. pages.

BIBLIOGRAPHY OF FOREIGN TRADE-1928. The National Foreign Trade Council, India House, 1 Hanover Square, New York City, has published a pamphlet entitled "Selected Bibliography of Foreign Trade-1928," which is considered as a carefully digested list of titles representing the concensus of opinion among leading foreign trade business executives, editors, educators and economists. The bibliography lists about 120 titles. It cites the most worth-while books on foreign trade practice, the merchant marine, trade with Latin America and the Far East, and reference books and directories. Also listed are a number of government handbooks and pamphlets of the Bureau of Foreign and Domestic Commerce. The pamphlet is available at the above address for 25 cents per copy.

FARM EQUIPMENT, MANUFACTURE AND SALE, 1927.—The Department of Commerce, Bureau of the Census, has published a pamphlet entitled, "Manufacture and Sale of Farm Equipment, 1927." The value and number of various types of farm apparatus manufactured in 1927, 1926, and 1925, are given. The total value of farm equipment manufactured in 1927 shows a decrease of about one-tenth of 1 per cent, as compared with that of 1926, a record year, but an increase of 17.5 per cent over the value of the 1925 production. The pamphlet is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., for 5 cents a copy.

NEWS OF THE WEEK

Elmer A. Sperry Inducted as President of Mechanical Engineers

Topics of wide interest discussed at A.S.M.E. annual meeting

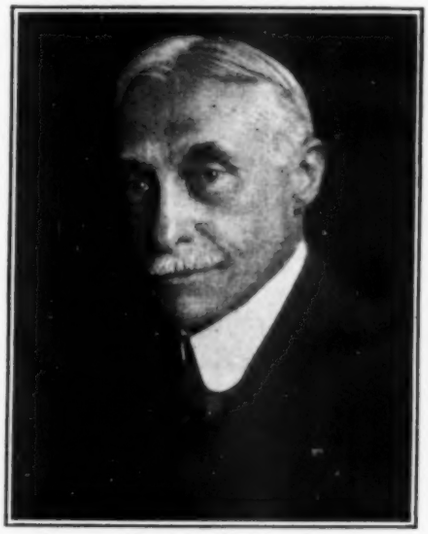
IN VIEW of the interest of American engineers in the forthcoming World Congress of Engineering to be held in Tokyo next October, the election of Dr. Elmer A. Sperry to the presidency of the American Society of Mechanical Engineers is particularly appropriate. Dr. Sperry has always been interested in Japanese affairs, and active in the promotion of friendly relations between Japan and the United States. He had much to do with the conception of the idea for the Congress.

Elmer Ambrose Sperry, new president of the American Society of Mechanical Engineers, who took office during the annual meeting, was born in Cortland, N. Y., October 12, 1860, and has been an inventor most of his life. In 1879, at the age of 19, he invented one of the first successful electric arc lights in America. In the following year he founded the Sperry Electric Co., of Chicago, and manufactured arc lamps, dynamos, motors, and other electric appliances. In 1883, he built the largest electric beacon in the world and equipped it with a 40,000-candlepower light. In 1888, he won the distinction of having been the first to produce electrical mining machinery. He also designed electrical street railway cars and founded the Sperry Electric Railway Co., of Cleveland, to manufacture these cars, which he continued until 1884, when the General Electric Co. purchased the patents. One of the earliest successful electric carriages is also attributed to Mr. Sperry.

An important commercial process for producing caustic soda and bleach is due to his activities. The National Battery Co. was organized and still operates under Sperry patents. An electrolytic process for producing white lead from waste products of copper mines is also attributed to him.

About thirty years ago, Mr. Sperry turned his attention to the gyroscope, and from it produced the now well-known gyro-compass and gyro-stabilizer. He has also done much to increase the efficiency of arc lights, and has developed a high intensity arc searchlight, using a positive carbon with a mineralized core for producing a vapor that increases the brilliancy many times.

From time to time, Mr. Sperry has made substantial contributions to the development of internal combustion engines, his greatest achievement being a compound Diesel engine lately put into a practical power plant using a low grade of fuel oil. He has also been interested in aeronautics and was awarded the first prize by the Aero Club of France in 1914, for his airplane stabilizer, or automatic pilot. In 1927, he received the John Fritz Medal award,



Elmer Ambrose Sperry
President, American Society of Mechanical Engineers

given jointly by the four national founder engineering societies for his development of the gyro-compass and the gyro-stabilizer.

Mr. Sperry is a charter member and founder of the American Institute of Electrical Engineers and the American Electrochemical Society. He is a member of the A.S.M.E., the American Chemical Society, Society of Naval Architects, and Marine Engineers, Society of Automotive Engineers, and many others. He has received many awards and has been decorated by the governments of Russia and Japan.

Technical Sessions

The large attendance at the sessions of the Machine Shop Practice Division indicates a real and growing interest in subjects pertaining to production. The progress report by L. C. Morrow, editor, *Industrial Engineering*, and the retiring chairman of the division, was comprehensive and was well received. Prof. Roe's paper on the Principles of Jig and Fixture Practice was a distinctive contribution to industry, and has been published in full elsewhere in this and the preceding issue of the *American Machinist*.

The second session of this division dealt with Methods of Motor Application and Controls on Lathes, by Chas. L. Cameron; Motors for Planer Service, by F. E. Cardullo; Motor Drives for Precision Grinding Machines, by R. E. W. Harrison; and Application of Motors to Special Drilling and Tapping Machinery, by J. H. Mansfield. All these papers elicited much discussion from various angles and brought out a great diversion of opinions as to motor sizes, plain and anti-friction bearings and numerous other points. Abstracts of them are to be found elsewhere in this issue.

Paper on Carboloy

Mechanical Applications of Chromium Plating, by W. Blum [abstracted on page 921], and Carboloy and Tungsten Carbide Tools, by Samuel L. Hoyt, furnished the topics for the third and last session. Both were timely subjects and the authors, each a well-known authority in his field, brought out many interesting points of practical value. Discussion disclosed a wide variety of ideas on both subjects, some looking ahead to possible new ways of utilizing the new cutting materials. Many points of practical value were brought out and much helpful information given.

The most interesting part of the Business Meeting was the presentation of three awards. The Junior Award went to Michael D. Aisenstein of Berkeley, Calif.; the Chas. T. Main Award to Robert M. Meyer of Newark, N. J.; and the Student Award to Clarence C. Franck of Baltimore, Md.

Preliminary Findings of a Study of Intensive Types of Technical Education, presenting advance data by Robert H. Spahr, in charge of the study of industrial requirements, for the Society for the Promotion of Engineering Education, dealt with non-college types of technological education, defined the scope of the study and analyzed the responsibilities of supervisory positions such as foremen and superintendents.

Technical Committee No. 3 on Machine Tapers, held a protracted and strenuous session at which the proposed taper of $\frac{3}{4}$ in. to the foot and the sizes recommended by the sub-committee were vigorously discussed. No decision was reached however, as the committee has no wish to force or even advocate a new standard unless the majority of those who use tools having taper shanks so

desire. It has been proposed to augment the Morse taper sizes by adding other numbers, and on all tapers, above a No. 5, to use $\frac{1}{4}$ in. to the foot. Before recommending this, or any change, however, the committee decided to seek more information from users, showing them both proposals and abiding by the desires of those most affected—the users. Details of the proposed changes will be published in these pages at a later date.

Better Lighting Advocated

Better lighting in factories as a means of reducing the number of accidents was advocated by speakers at a meeting of the illumination division. It was said that industrial accidents were 100 per cent greater in winter than in summer, partly because of the increased amount of work done by inadequate artificial illumination.

A report prepared by C. C. Monroe and H. A. Cook asserted insurance records showed that 15 per cent of all industrial accidents are due to defective lighting. The report also declared that compensation claims traceable to defective lighting cost American manufacturers $2,000,000 yearly.

Messrs. L. P. Alford and J. E. Hannum in a joint paper reported the rating of the more important American industries by a new standard of comparison. The data used came from more than thirteen thousand concerns, using about three and one-half billion man-hours of labor.

New "Yard-Stick" of Management

The authors demonstrated that some industries produce nineteen times as much value as others for the same amount of labor. The actual figures range from $10,870 down to $548 value of product per thousand man-hours of labor. This new "yard stick," which they call the Kilo-Man-Hour, or K. M. H., is expected to revolutionize the rating of American industries.

The findings of the authors were submitted as a basis for further development. At the conclusion of the paper it was recommended that man-hours of labor be reported in the United States census, so that this method of evaluating the efficiency of industries may be generally used.

Contrary to popular impression, small concerns are shown to be managed better than large ones when tested by this basic method of analysis. Emphasis was laid on the fact that this new method discloses a ratio of difference in favor of the small concern much greater than was realized. On the basis of labor employed the smaller concerns on the whole produce more in quantity and in dollar value per man-hour of labor. They add more value by manufacturing to the raw materials which they employ.

In discussing this paper, Charles P. Tolman, consulting engineer, stated that the character of manufacturing equipment employed obviously must be a large factor in this wide range of productive results per Kilo-Man-Hour (K.M.H.). There must be other offsetting factors which are now holding net profits at a fairly uniform level in spite of these surprising differences in output per unit of labor. These factors we must find and learn to control.

The annual Robert Thurston lecture, named in honor of the first president of the society, was delivered by Dr. Wheeler P. Davey, Professor of Physical Chemistry in Pennsylvania State College, whose topic was "The Elastic Properties of Materials as Shown by Crystal Investigations." He stated that the results of X-ray experiments by Joffe and others, with quartz and rock salt crystals, lead to broad generalizations which help to clear up obscure points in the properties of materials of construction. These have to do with Hooke's law, elastic fatigue, destruction of limit, the mechanism of plastic deformation and the cause of tensile strength.

"If we can learn enough about the forces of nature and the principles which underlie the properties of materials, we can hope to predict the properties of hitherto untried materials," he asserted in conclusion.

President's Night

On Tuesday evening President Alex Dow presented his final address, an essay on the quotation "Consistencie, thou'rt a jewel." In the course of it he remarked that more consistency in the confining of the activities of the society to purely engineering subjects would be desirable.

Honorary memberships were conferred upon Dean Mortimer E. Cooley of the University of Michigan, and Dr. Ira N. Hollis of Worcester Polytechnic Institute.

Dr. Masawo Kamo, dean of engineering at the Imperial University of Japan, president of the Japanese Society of Mechanical Engineers and chairman of the organizing committee of the World Engineering Congress to be held in Japan in 1929, was present as the guest of the society. He was introduced by President Dow and explained briefly what would be of interest to visitors to the Congress.

After the report of the letters of election had been presented, President Dow introduced the president elect, Dr. Elmer A. Sperry.

Mechanics the Most Intelligent

Mechanics are the nation's most intelligent class, with engineers and technical men second and business men third, Dr. Edward E. Free, New York scientist, declared at the annual dinner of the society held on Dec. 5. Actors, physicians, ministers and professors rank lowest in the intelligence scale among non-morons, he added.

"Intelligence is the ability to reach a reasonably correct conclusion from a set of discoverable facts," he declared, if average ratings of thousands of individuals are to be trusted.

The study of humanity, Dr. Free said, has been left too much to statisticians and psychologists, whose viewpoints he regards as oppositely incomplete.

Other speakers at the dinner included Dr. Elmer Ambrose Sperry, the new president of the society, and Alex Dow of Detroit, the retiring president. Colonel Paul Doty acted as the toastmaster.

President-elect Sperry said that his only hope was to keep the society going under the impetus imparted by his two predecessors. He called attention to the World Engineering Congress and urged the members to attend if possible.

Mr. Schwab charged the new members of the society with the responsibilities as engineers, and presented Julian Kennedy to the gathering for his reception of the A.S.M.E. medal for his services to the iron and steel industry.

France Awaits Attitude of New Ministry And Its Relations To Industry

Struggle of labor against machine dominance seen

By Our Paris Correspondent

THE radical changes just brought about in the new French cabinet have done nothing to strengthen the economic and industrial situation. Employers, workers and consumers alike seemingly express an attitude of expectancy rather than of assurance that things are all for the best. Meantime production and distribution again lag. Actually, consuming needs have shown no shrinkage, but it is feared that moderation and conservatism will soon manifest themselves among the consuming public when industry itself will be bound to take to cover.

Reparations, war debts and the evacuation of the Rhineland by French troops are all questions which befog many other issues and until they are definitely settled once for all, economic and industrial France will still be subject to violent tremors which are not conducive to the steady march of affairs. The equilibrium so long hoped for and desired still seems far away.

An opinion recently launched by the Association of Salaried Technicians of the metal trades, quoted summarily, is to the effect that concentration and *rationalization* have brought about instability of employment, retrogradation among skilled employees, and low wages. It is further suggested that this is but a prelude to a profound crisis to come. This can refer to but one thing which can be tangibly visioned—the increasing introduction of automatic machinery for many operations where formerly manual labor was more largely employed. The point is worth noting at the moment when American machinery is being made increased use of daily in France.

That the traffic is actually due for a slow-down may well be doubted, but if the suggestion quoted means anything it means that scientific management, in one or another of its phases, is, in France, something the worth of which has yet to be impounded in the minds of the directive personnel, working at a salary, as well as in the minds of mere labor, working for a wage.

German Bicycle Competition

A minor phase of the metal fabricating trades from the American point of view, though important in magnitude for France, is the difficulties which are besetting the bicycle manufacturing industry of Saint Etienne and elsewhere. Heretofore, French manufacturers have supplied the home market, but there is a growing fear that the excess of German bicycle production (said to be 2,400,000 units per annum) will curtail this on the price issue alone, though the industry of itself here believes that it is working under as favorable conditions as possible.

There is talk of the formation of a syndicate of French wire manufacturers which will ultimately join in with the International Syndicate, thus stabilizing, even rationalizing, an important branch of the metal industry.

It is proposed to found a Metallurgical and Machinery Institute at Paris analogous to that which specializes in foundry technique. Instruction will be given by those of a practical experience in the industry. The object is the comprehension and exact application of mechanical processes and machine operation in the metal trades, not neglecting scientific management and organization. In time this may be expected to have its effect. A conference on the subject was recently given by Monsieur de Freminville of the National Committee of French Organization and a director of the famous Schneider works at Le Creusot.

Few Tool Purchases

Except for tentative plans for the future the interest in new machinery installation is for the moment virtually at a standstill. Various enterprises in the metal-transforming industry are said to be hesitating in their search for new capital for extension uses, due to the fact that increasing taxation, the low value of the franc and the still rising cost of living are limiting the purchasing power of the consuming public. Stabilization of the franc is said to be the cause and is expected to remain so throughout the period of adjustment of family and personal budgets.

Welfare work in manufacturing plants is developing rapidly. This is something which was virtually unknown in France before the war. The first general effects of such were those observed as the result of such methods applied during the war when a large proportion of female labor was employed in many industries where it was hitherto unknown. The Association of Superintendents of Social Work in Manufacturing Industries—which has been recognized by the government as a public utility—has 156 members. Demands for such directive employees have been received recently from 42 metallurgical and metal-working industries and from eight electrical industries.

Import and export statistics referring to tools and machinery during the first six months of the year are now available and show some remarkable changes of position with respect to imports from the United States and Germany.

In 1926 the values of such from Germany were about 10 per cent of those of similar goods from the United States. In 1928 those from the United States had fallen nearly 50 per cent, while those from Germany had increased nearly 60 per cent. There is, of course, no real approach of the totals as yet, but Germany's gains are significant.

Another curious observation is that in 1928 the value of Germany's shipments in these lines worked out at 787 francs per metric quintal (220 lb.), while at the same time those from the United States showed a valuation of 2,532 francs per quintal. This certainly points to the fact that the French buyer is turning to the German makers only for the smaller, cheaper tools and that the high-speed, all-inclusive product of American makers has as yet suffered but little.

French machinery and tools exported to the United States for the six months of 1928 were valued at but 218 francs per quintal. This modest figure seems to indicate that only the most summary of manufactured tools, possibly parts, are shipped to the United States from France.

It is of interest to note that the American type of electrically- or pneumatically-operated hammers, riveters and chisels are being manufactured in increasing numbers in France, as are many other small hand tools for metal working. Possibly the matter is insignificant, but it does show that France is preparing a home industry in most lines where not too great a capital and organization are required. As far as their attack on the American imported machine goes, only five big French makers of machine tools need be numbered, and at that they go for simplicity and moderation rather than for high-speed efficiency in their output.

World Engineering Congress Plans Show Progress

GREAT progress is being made by those in charge of arrangements for the World Engineering Congress to be held in Tokyo in October, 1929, both by the committees in Japan and in other countries, particularly in the United States. Nearly all European countries are to be represented by delegates, though the representation will necessarily be small from some of them. Austria, Belgium, Czechoslovakia, Denmark, France, Germany, Great Britain, Italy, Russia, Spain, Sweden and others will be represented both by delegates and by papers.

The Japanese committee has arranged a program that has just been made public, and which contains features that go the limit in attractiveness to delegates from all over the world. His Imperial Highness Prince Yasuhito of Chichilu is Patron, the Prime Minister of Japan is Honorary President, while the Minister of the Department of Commerce and Industry, Viscount Eiichi Shibusawa, is honorary vice-president. Baron Koi Furuichi, president of the Kogakkai, the engineering society of Japan, is the active president, and he is assisted by the leading professors and directors of the largest colleges and industrial plants in the island empire, assuring the whole hearted co-operation of all Japan.

To Dr. Masawo Kamo, professor of mechanical engineering in the Tokyo Imperial University, belongs the credit for inaugurating the movement for this congress, his activity dating back to the World Power Congress in London in 1924 and continuing to the present, as head of the organizing committee. Dr. Kamo is again in the United States, after visiting nearly every country in Europe and securing their co-operation. At a recent meeting of the United States committee, which is headed by Dr. Elmer A. Sperry and which was honored with the presence of Dr. Kamo, more details both as to the plans of the committee in Japan, and the progress of the United States committee, were made public. The publication committee, headed by James H. McGraw, gave a somewhat detailed account of the publicity secured and of the widespread interest that was being aroused throughout the country. Many applications are being received, and it seems likely that the official steamer, the President Jackson, will be filled to capacity when it leaves San Francisco on October 11, 1929. Many attractive excursions have been arranged by the Japanese committee, as well as receptions under official auspices. And to show the interest taken by the government itself, arrangements have been made for free transportation of delegates and one guest, over the governmental railways, a rare concession and an evidence of good will to all nations.

The object of the World Engineering Congress is to effect an international exchange of the latest knowledge of the science and practices of engineering and to bring together the leaders in research, education, and business. It is felt that as these are the men who are directing the trend of engineering activities, this gathering will initiate and promote the international co-operation and understanding that is so essential for the advancement of mankind.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

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READERS of this weekly review are requested to inform the writer whether or not the business men of their respective communities are noticeably interested in or impressed by the excitement in the New York Stock market that is attracting so much attention. This request is made because the mental attitude of the public toward the unprecedented boom will determine whether its ultimate collapse will have a salutary or injurious effect upon commerce and industry.

In a recent circular, the National City Bank of New York said that a moderate reaction in the stock market "would be the best thing that could happen for business," and there is no doubt that the stories of wealth recently acquired in Wall Street are commencing to create discontent in the rural districts of the country. Perhaps it may have been a factor in bringing about the decline in the stock market that took place last Thursday, and from which there has been only a feeble recovery.

The ostensible cause of this decline was an advance which carried call money to 12 per cent, and a report issued by the Stock Exchange which shows that as of November 30 its members were borrowing about $6,400,000,000 to finance securities that have been bought on margin. Inasmuch as this total does not include the loans made to thousands of security dealers in New York or elsewhere, who are not members of the Stock Exchange, it seems well within reason to assume that the aggregate of such loans is well in excess of $10,000,000,000 or more. This assumption is partially corroborated by the weekly report of the New York Federal Reserve Bank, which shows a further increase of $105,000,000 in brokers' loans.

It is superfluous to point out that this distention must be checked sooner or later, and the high rate recently paid for call money is a red light that ought to check the traffic which is now commencing to clog every avenue of finance. But until last Thursday the warnings given were unheeded.

Seats on the New York Stock Exchange have sold for $595,000 and it was concurrently predicted that they will be worth a million dollars in the not distant future. An investment trust organized last week by a banking firm that has been conspicuously successful, will have a cash capital of $100,000,000 that was eagerly subscribed for, and there are many who seem to believe that the supply of credit is unlimitable, although the extraordinary demand for it is making borrowers willing to pay higher rates.

This belief is apparently based upon the theory that the federal reserve banks and the agricultural land banks have become agencies through which nearly all forms of property can be converted into credit, and many thoughtful men who would have rejected this hypothesis a few years ago are now acting upon it. In the circumstances, a policy of watchful waiting would seem to be the only conservative course to pursue. Certainly those who think otherwise have been sufficiently cautioned.

It would, however, be inaccurate to assert or suggest that the gyrations of the stock market have yet had any perceptible or repressive effect upon trade or industry. They have made merchants careful about carrying big inventories, but that is all.

The demand for staple goods is excellent. Car loadings continue to run well ahead of last year, and the consumptive demand for nearly every form of merchandise is fully up to production.

The cheerfulness of the steel industry is undisturbed. The automobile manufacturers are optimistic. The new building planned is still running ahead of last year's record, according to the November figures, and there is little or no unemployment in any quarter. Rubber is a shade firmer.

The assembling of Congress and the President's message appear to have attracted little attention among business men. There is a deep-seated conviction that the present Congress will not pass any important legislation other than the appropriation bills, and it is taken for granted that Mr. Hoover will have to call a special session to deal with the farm relief problem. Therefore, it is not expected that the political news will have much effect upon business until after March 4.

The illness of King George has slightly chilled speculation on the London Stock Exchange, but the news from abroad is not otherwise important or significant. In Europe the Christmas holidays embrace a period of fully a fortnight, during which business is normally quiet.

The cables from the Orient do not report any developments of fresh importance, and the whole world appears to be preparing to forget its troubles as Christendom celebrates the greatest festival of the year.

This is particularly true of America, where the only dark spots upon the commercial map are to be found in the agricultural regions of the South and the West which have just cause for complaint that the prosperity of the cities does not include the sections where most of the population is dependent upon the land for a living.

WHAT'S DOING IN INDUSTRY

MACHINE TOOL trade in most industrial centers is being maintained at a high level for the season, and as the record business of 1928 comes to a close manufacturers and dealers look forward with considerable optimism to the new year. There is no indication at present that the unprecedented buying of machine tools will taper off, as activity in the metal-working shops appears to be on the increase.

IN DETROIT, a seasonal depression is still noted, allowing local dealers to catch up on deliveries. While the automobile shops are slowing up, the small shops are all well occupied. Chicago reports a slight seasonal decline also, and the South is somewhat below normal in this field, where the textile industry is the leading buyer of equipment. Cincinnati, on the other hand, reports that the demand is still holding up, with many urgent orders and inquiries. Continued good business in this line is found in Indianapolis, and many hitherto indifferent buyers are entering the market. One of the sustaining features has been purchases of equipment by the coal mines; another, sales to automotive body and accessory plants. A steady volume of orders is reported in New England, with much industrial expansion under way. Business is being maintained at a high level in New York also.

RAILROAD purchases are still below normal in Chicago and New York, but are considered satisfactory in Indianapolis. Manufacturers of this class of equipment, however, anticipate increased business in 1929 on the basis of the recent improvement in earnings of some of the roads. Rail and car orders are the feature of the Canadian market, and much activity in other lines is reported there as well.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, incidate the trend of business in these industries and what may be expected from the future:

INDIANAPOLIS

Continued good business features the machinery and machine tool business here. In fact reports are considerably more encouraging than they were at this time last year and from all present prospects the new year will be ushered in under much more auspicious circumstances. Many of the industries that have been rather indifferent buyers for some time are coming into the market for fair orders and there is not nearly the spottiness in the business there was a year ago. As compared with more recent periods, the business will be found in a favorable condition.

Of course one of the biggest recent boosts to the business has been the resumption of mining in the bituminous field, particularly Indiana and Illinois. The Indiana mines, which were down for seventeen months, are not yet back in full production, but the properties are being put into condition and a large volume of replacement machinery is being purchased. Virtually all the operators are re-equipping their machine shops also and this calls for a number of small tools.

A fair demand is seen from the railroads, but the tendency is to keep purchases to absolute essentials and not draw too much motive power from the road for repair work unless absolutely necessary. The automobile demand is fair, but the biggest demand in the automotive field seems to come from the body and accessory business. The latter is particularly a good prospect for tools and special machinery.

The iron and steel demand is fair and is more active than a year ago. Second-hand machinery dealers report a fair volume, but some shopping around over prices.

SOUTHERN DISTRICT

Machinery and machine tool distributors in the southern district are optimistic over the outlook for business in the first few months of 1929, the volume of inquiries reported being larger than they were at this time last year and of a tone which indicates that sales the first quarter of 1929 should be well in excess of that period in 1928. Business the last week of November and the first few days of December showed improvement over the previous two weeks, but with the holiday season at hand distributors are not looking for much activity in buying until early in the coming year.

The textile industry continues to be one of the leading buyers in the Southeast and, with an unsually large amount of new mill construction under way, should continue active for some time. The outlook is especially good for the first half of 1929 as announcement has been made of millions of dollars to be invested in mill buildings, most of them to be started early in the new year.

Though some sales of woodworking machinery are being made to southeastern furniture plants and some equipment is also being taken by other concerns in the woodworking field to be installed during the period of idleness when the mills shut down over the holidays, as a whole this business is quiet, and considerably less than at this time last year. However, inquiries are fair and early 1929 outlook promising.

Railroads are doing some buying for shop projects now under way, and inquiring on a good basis for needs the next few months. Smaller machine shops and garages are placing but few orders, nor does the outlook seem very promising for the first part of the new year. Road building equipment is at present inactive but with virtually all of the southeastern states planning an investment of several million dollars in new road construction and maintenance work in 1929, distributors look for this to be an excellent field next year.

CANADA

According to reports from all sections of Canada, activity in the machinery and machine tool field is being well maintained. Industrial conditions generally throughout the Dominion are at a high level. The iron and steel mills, the automotive industry, and the building trades are particularly well employed. Production in the automotive industry is an outstanding feature. Cumulative output for the first ten months of the current year aggregated 221,188 cars, as compared with 169,331 units made during the corresponding period of last year. At the end of November, production had exceeded that for the whole of last year.

In the iron and steel trade there is a fair amount of new business offering, while orders on hand represent several months work. President W. C. Franz, of the Algoma Steel Corporation, recently stated that sufficient orders had been received to keep the rail mill operating until the end of March, and that quite a number of orders were pending. The Hamilton Bridge Co., Ltd., has greatly exceeded its estimated output of 48,000 tons in their east-end plant at Hamilton, Ont., and they expect to reach peak production on the receipt of further orders necessitated by the 8 million dollar expansion program of the Steel Co. of Canada. The Canadian Locomotive Co., Kingston, Ont., will shortly commence the construction of 30 new locomotives for the Canadian National Railways.

As a result of orders closed during the past few weeks, it is learned that the Canadian Car and Foundry Co., Ltd., now has on its books a total of $20,000,000 of business. The largest orders have been placed by the two principal railways, but recent contracts have included one for several hundred tank cars from the Imperial Oil Co., Ltd., and another for 106 street cars for the Montreal Tramways Company.

The outlook for the construction industry during the winter months is bright. New construction, including both buildings and engineering work, contracted for during November totalled $29,038,000. This figure brought the total amount of new construction started in Canada since the first of the year up to $453,127,400, this being an increase of 18.5 per cent over the same period last year.

CHICAGO

The first week of December shows some let-up in the buying of machine tools. This recession, however, according to machinery men, was to have been expected, the near approach of the holidays and the starting of inventories usually being productive of a slowing up in business. There still is a good demand for nearly all types of machine tool equipment, however, and, while the month of December will not equal November in the total volume of sales, generally speaking, it is not believed the difference will be large. Present demand principally is credited to general industry, although makers of agricultural machinery and tractors still are important factors in the market.

Railroad buying has shown but little improvement, nor is it thought there will be any appreciable activity until January or February. As stated last week, the outlook for business from this source is said to be not of the brightest, though some good lists are looked for from two, or possibly three, Western roads.

Used tools are selling fairly well, but demand has fallen off somewhat during the last week. Inquiries for this class of equipment indicate that the lull is only temporary.

CINCINNATI

Business of the machine tool manufacturers of the Cincinnati district held up in a most satisfactory way in the past week. The great majority report a gain in sales, comparing the week to the previous one. A large number of rush orders for equipment were received, and due to this fact it has been necessary in many cases either to add men to forces or to work overtime. The opinion expressed by heads of different concerns is that the demand will continue at a good level.

While the sustaining feature of the market continued to be the sale of single tools, an increased proportion of the week's orders called for two or more pieces of equipment. Scattering orders for single tools and replacements were received from railroads and concerns in the automotive industry. One large export order came from Italy and several small orders were received from other foreign markets.

Inquiries came in freely during the week, many of them being of an urgent nature which indicated that the buying was to be done quickly, not with the usual delay. The major portion of the inquiries came from miscellaneous users and the great majority of them were in regard to single tools. Inquiries reported from the railroads and the automotive field were confined to single pieces of equipment.

NEW ENGLAND

The remarkable steadiness of the New England machine tool market has been the outstanding and somewhat surprising feature of the early weeks of December. Orders show little fluctuation with no indication that an immediate change will be experienced. Manufacturers are finding the healthy industrial conditions most agreeable, and business surprisingly sound. It is usual to look for a substantial let-down in bookings at this period, but buyers continue to show keen interest and will likely close on lists of importance before the first of the year. The delivery problem is in a measure responsible for the steady forward buying.

Maine industrial conditions have reacted favorably and plants are enjoying a spurt comparable to other New England factories. The Bingham $7,000,000 hydro-electric project is a boom to business in many lines. Axes, shovels, picks, cant-dogs and similar tools needed, run into 1,000 or more of each item. The project will take 150 tons of coal weekly, a total of 150,000 barrels of cement and about 2,000 tons of reinforcing steel, and a good amount of conveying equipment.

Productive activity and man hour schedules in industrial centers of New England, with few exceptions, are at this

time proceeding at a rate well above the corresponding period last year. Plant expansion is a strong feature of building programs. Outstanding among these projects is a $400,000 airplane manufacturing plant at Stratford, Conn., for the Sikorsky interests, now in the course of construction, and proposed additions to the Crane Co. plant and the Bridgeport Brass Co.'s rolling mills.

DETROIT

Business in the machinery and machine tool trade is still in its seasonal period of depression and from all present indications will remain that way at least until after the holiday season. Automotive activity has slacked down considerably for the past six weeks or two months, and the easing down process is still noticeable. Most of the automobile manufacturers are ready, or nearly ready, for the New York show, their preparations having been begun a little earlier this year than usual.

Business has been better at this season than it usually is and a great many dealers are busy getting deliveries on machinery and equipment ordered some months ago. Some new orders are still coming in, of course, but they are nearly all small.

The small shops here are still unusually busy. This has been a remarkably good year for all of them, and the indications are that next year will continue to be fruitful.

By all odds 1928 has been the best period ever experienced by the trade in this district. Competition has been unusually brisk and at times it has been necessary to reduce prices some. Yet the volume of business and the net income to dealers and manufacturers has been much greater than ever before.

NEW YORK

From present indications it appears that sales of machine tools in the metropolitan area will be maintained at a high level throughout the month of December, although a few of those interviewed believe that there will be a let-up as the holidays and the end of the year approach. Few are of the opinion, however, that much buying will be deferred until after Jan. 1 because of the exhaustion of present appropriations. On the contrary, the reverse attitude is taken, because it is felt that with present metal-working activity at a high level, needed equipment is being bought, regardless of other considerations.

The market at present is characterized largely by orders for single tools from well-scattered sources, which in many cases had not been heard from in a year or more. Some miscellaneous orders were received from the Wright Aeronautical Corporation in the past week to round out the previous large purchases. It is not expected that any quantity buying by R. Hoe & Co. will take place for some weeks, purchases of grinders, engine lathes and turret lathes being anticipated.

The New York Central R.R. has inquired for a radial drill and two grinders. Except for a group of tools bought by the Delaware, Lackawana & Western many months ago, the New York Central is the only road that has made any purchases worth mentioning in the past year in this market, and even this business was not up to normal. Concerns specializing in railroad shop tools feel that there is bound to be a better market for their product in 1929 due to the improved earnings of the roads and the fact that the condition of rolling stock demands the purchase of repair equipment, long deferred.

The sales of grinding wheels, drills and cutters continue at a high level, indicating much shop activity.

Sales made by the Triplex Machine Tool Co. in the past week included: two bench drill presses, three sensitive Edlund drill presses, an Ames bench miller, three Blount tool grinders, a large Universal tool grinder, a large filing machine, a hand milling machine, a valve seat grinder, three Ames bench lathes, a Campbell nibbler, two floor arbor presses, a power marking machine, and a floor tapping machine.

Aeronautic Production High in 1928

A recent analysis made by the Aeronautical Chamber of Commerce indicates that aircraft production of all types in this country during 1928 will exceed 4,000 planes with a total market value of $75,000,000. In 1929, it is expected that 12,000 planes will be manufactured, with a resulting turnover of about $100,000,000. These figures are a startling contrast to the 1,995 airplanes, valued at $5,000,000, produced in 1927, and to the complete absence of commercial production in 1921.

Three cities are the outstanding contenders for recognition as the "air capital" of the United States. They are Wichita, Detroit and New York. It is estimated that in 1929 the factories in Wichita will produce 1,870 planes, with a retail value, less motors, of $9,937,500. Detroit's plants place their production at 420, but, due to the size of the ships, rate their total value at $11,657,500. Both Wichita and Detroit have motor plants just getting into production and these should, of course, add greatly to the respective totals.

New York, however, remains the unquestioned leader in production. Estimates for 1929 from six big firms, but not including one of the largest, place the commercial plane production figure at 2,815 and the retail value, less motors, at $21,456,250. In greater New York are located certain of the outstanding motor manufacturers, the value of whose total output in 1929 is estimated as approximating the amount quoted for planes, thus giving New York City alone a total estimated aircraft turnover for 1929 of $35,000,000 to $40,000,000.

Foote Bros. Gear Company Buys Equipment Companies

According to plans announced in the *American Machinist* last week, the stockholders of the Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., have voted to purchase four companies specializing in the manufacture of highway and road-building equipment: Lyle Culvert & Road Equipment Co., Stockland Road Machinery Co., and the Northwestern Steel & Iron Co., all of Minneapolis, and the Bates Manufacturing Co., of Joliet, Ill. The acquisition of these companies has necessitated an increase in capitalization of Foote Brothers to 250,000 shares of common stock, which, together with 8,000 shares of preferred stock originally issued, represent a market value of capitalization of about $10,000,000, and establishes the company as one of the large manufacturing institutions of the country. Besides providing funds for the acquisition of the four companies mentioned, the increase in capitalization gives the Foote Brothers $1,250,000 new cash capital which will be used for additional expansion. These purchases greatly enlarge the field of operation of Foote Brothers, providing the company with production processes and facilities for a large part of their own raw materials. Most of the companies acquired are quantity users of gear products which will increase the gear and reducer production of the parent concern.

Huge Aviation Holding Firms Are Formed

Formation of the largest aviation holding company in the world, with $25,000,000 capital, was announced recently by C. M. Keys, president of the Curtiss Aeroplane and Motor Co., Inc. The new company will be North American Aviation, Inc., and will specialize as a holding company in investment and development of the aviation industry in Europe and in the United States. It is backed by large air and banking interests.

The General Aero Corporation has been organized as a holding and operating company covering the entire aircraft field. Simultaneously with this announcement, the company announces that it has acquired control of the Swallow Airplane Co. and the Cessna Airplane Co. In addition, control has been acquired of a large propeller company and an airplane concern. A large New York City airport has also been taken over. Financing has been handled by a syndicate headed by E. H. Holmes & Co. The directorship of General Aero will be an interlocking one embracing the entire list of acquisitions.

Dr. Masawo Kamo Addresses McGraw-Hill Editors

Dr. Masawo Kamo, chairman of the organizing committee of the World Engineering Congress to be held in Japan in the autumn of 1929, visited the McGraw-Hill Publishing Co., Inc., New York City, on December 7, to give first-hand information to the principal editors of McGraw-Hill industrial and business papers regarding the plans for the Congress. According to Dr. Kamo, the American delegation will be considerably larger than all of the European delegations combined. On the other hand, Germany and England are bending every effort to present technical papers on various engineering subjects that will hold the center of attention.

Ford to Build Assembly Plant in Turkey

The Ford Motor Co. has concluded a contract by which the Turkish government grants land in Constantinople for the erection of an assembly plant for automobiles, trucks, tractors and airplanes. The concession is to last for 25 years, with special customs privileges permitting free entry of all machinery for the plant and all parts for the construction of the machines, the company paying $30 for each com-

pleted unit. The company is required to employ Turkish workmen exclusively and to use Turkish coal. It is estimated that the output of the proposed plant will be nearly 200 cars daily.

Business Items

The Pennsylvania Forge Co. has moved its main office to its new plant at Milnor and Bleigh Streets, Tacony, Philadelphia, where all manufacturing operations will be concentrated.

The Allis Chalmers Manufacturing Co., Milwaukee, has announced a $2,500,000 expansion plan for its tractor department. Allis Chalmers has signed a contract with the United Tractor & Equipment Co., to supply a light tractor.

The Geometric Stamping Co., 221 East 131st St., Cleveland, is planning to build the first unit of a new plant to cost about $600,000. The company manufacturers automobile stampings, metal furniture and variout radio parts. The proposed unit will contain 150,000 sq.ft. of floor space.

The Wisconsin Screw Co. has moved to new and larger quarters in Racine, Wis. The plant has been equipped with new machinery, and the company is in the market for additional equipment. The new plant will provide three times the former capacity. The officers of the company are: President, Stanley Keleske; vice-president, John H. Liegler; secretary and treasurer, Paul H. Keleske.

Negotiations are being conducted by Curtis Aeroplane and Motor Co., Inc., for the acquisition and control of the Curtis-Reid Aircraft Co., Ltd., organized to acquire Reid Aircraft Co., Ltd., of Montreal. Under the present plans the Curtis Aeroplane and Motor Co., Inc., will purchase for cash 51 per cent of the common stock of the company presently to be outstanding and the balance will be sold for cash or issued in advance for assets of Reid Aircraft Co., Ltd.

The Johns-Manville Corporation, Inc., 292 Madison Ave., New York City, has purchased the assets and the entire line of products of the Celite Products Co., 11 Broadway, New York City. The latter brings to Johns-Manville an annual business of over $4,000,000 in net sales of high-temperature insulation and kindred lines made from diatomaceous earth, a fossilized deposit derived from ancient sea life. Large holdings of a deposit in California, which is one of the largest known sources, were owned by the Celite Company.

The entire plant of the former Standard Turbine Corporation at Scio (Wellsville), N. Y., is to be sold at public auction on Thursday, December 20, by the Industrial Plants Corporation, of New York City, which has been engaged by the Bondholders' Protective Committee to conduct this sale. This sale will mark the end of the corporate existence of the Standard Turbine Corporation, as well as the Scio Manufacturing Co. The equipment to be sold includes lathes, shapers, planers, milling machines, drills, cranes, boring mills, turbines, and generators.

The Barber-Colman Co., Rockford, Ill., announces the appointment of the following agents for its hobbing machines, hob sharpening machines, milling cutters, and tools: Lloyd & Arms, Inc., 133 S. 36th St., Philadelphia, Pa., for the Philadelphia territory; the Rosenfelder Machinery Co., 1024 Post Dispatch Bldg., Houston, Texas, for the Texas territory, and J. R. Walraven, Forsyth Bldg., Atlanta, Ga., for the Georgia territory. W. M. Oplinger, 1023 Widener Bldg., Philadelphia, is agent for the Philadelphia territory for the company's small tools.

The properties of the McMyler-Interstate Co., a large manufacturer of steam shovels, pile drivers, forgings and excavating machinery, of Bedford and Cleveland, were ordered sold upon demand of the Union Trust Co., of Cleveland, holder of $1,312,800 in bonds mortgaged against the property. Last April the company went into receivership because it owed $2,000,000 and needed money to continue business, although its assets were above its liabilities. P. A. Connolly, who has acted as receiver for the company, has been appointed special master to dispose of the holdings by public auction.

An extensive expansion program is being carried out at the plant of the Canadian Vickers, Ltd., following an agreement effected with the Fokker Aircraft Corporation of America, permitting the former to manufacture Fokker Universal, Super-Universal and F 10 types of planes. George Barr, vice-president and general manager of Canadian Vickers, in outlining the program of his company stated that the present factory which utilizes nearly 100,000 sq.ft. would have an immediate addition of some 80,000 sq.ft. One of the old machine shops used during the war for the manufacture of shells will be turned over exclusively for the construction of Fokker wings, while a new addition to the aircraft factory will be used for the manufacture of Fokker fuselages.

The Joseph E. Knox & Co., Inc., Lynn, Mass.; O. M. Savels & Co., Worcester, Mass.; the John Dewes-Gumbs Die Co., New York, N. Y.; the Brockton Die Co., Brockton, Mass., and the Hub Skiving Knife Co., Brockton, all five being prominent cutting-die manufacturing companies of the East, have consolidated as the Cutting Die & Machine Co. of America, Inc., with headquarters at Lynn, Mass. The new organization is incorporated under the laws of Massachusetts, and has 25,000 shares of capital stock. The officers of the concern are: President and general manager, James V. Knox; vice-presidents, Joseph E. Tougas, George A. Gumbs, Joseph K. Knox, and John Dewes; treasurer, Orvis M. Savels, Jr.; secretary, Orvis M. Savels, and assistant treasurer, Roy M. Knox.

Personals

W. B. MARSHALL has been appointed sales manager of the contract engineering department of the Chain Belt Co., Milwaukee.

ARTHUR L. COLLINS has been made manager of the tool and alloy steel division of Horace T. Potts & Co., Philadelphia, Pa. He was formerly sales metallurgist.

R. M. SANDBERG has been appointed general manager of the Columbia Tool Steel Co., Chicago Heights, Ill. He has been with the company for the past 16 years.

HARRY F. O'BRIEN, general manager and vice-president of the International Silver Co., Meriden, Conn., has resigned and will become an official of the Gorham Co., Providence, R. I., on January 1.

PAUL H. HENNING, formerly vice-president of the Detroit Screw Works, Detroit, Mich., has become affiliated with the Wise Industries, 1033 Mt. Elliott St., Detroit. The firm does chromium, nickel and cadmium plating.

CHARLES WASHBURN has resigned as manager of the North Bay office of the General Supply Co. of Canada, Ltd., in order to become sales representative for Northern Ontario for Sawyer-Massey, Ltd., Hamilton, Ontario.

VERDON PEARSON, formerly mechanical superintendent of power houses and mechanical equipment for the Alberta government, has resigned to take charge of the Edmonton branch of Electrical Engineers, Ltd. Previous to entering the service of the Alberta government in 1923, Mr. Pearson was chief engineer and master mechanic of the Canmore Coal Company.

HUBERT C. HART, president of the H. C. Hart Manufacturing Co., Unionville, Conn., cutlery manufacturer, has retired from business, and is succeeded by his son, Edison W. Hart, who becomes president, treasurer and general manager of the company. The elder Mr. Hart is 84 years old and has been connected with the company since 1867. He succeeded his father as head of the company about 1877.

FRANK V. HADAS, who was connected with the Ford Motor Co., Detroit, in charge of branch manufacturing operation, has been appointed factory manager of the General Motors Truck Corporation, Detroit, to succeed H. J. Warner who becomes assistant to the president. Mr. Hadas, since resigning from the Ford organization two years ago, has been identified with the airplane industry.

WALTER M. GRAHAM, of Toronto, Ont., has been appointed manager of the contract department of Sawyer-Massey, Ltd., Hamilton, which department has been organized to handle sales of special equipment, manufactured in the plate, structural, sheet-metal and machine shops of the concern. For two years Mr. Graham was branch manager at New York City for the Gurney Heater Co., Inc., Boston.

W. J. HOLTMEIER has been appointed to take charge of the sales and advertising of the Hill-Curtis Co., Kalamazoo, Mich., manufacturer of polishing and grinding machinery. For the past twelve years Mr. Holtmeier has been associated with the Hisey-Wolf Machine Co., of Cincinnati, in various capacities, the last three years as general sales representative and advertising manager.

CHARLES A. LAMPHARD has been appointed special sales representative of the Poldi Steel Corporation of America for the New England states. He was previously connected with the Yale & Towne Manufacturing Co. in charge of metallurgical work, and prior to that position, with the Remington Arms-Union Metallic Cartridge Co. in charge of the heat-treating departments at Bridgeport. Mr. Lamphard was also at one time with the General Electric Co. as furnace and metallurgical specialist.

O. S. JACKSON, formerly superintendent of motive power and machinery of the Union Pacific R.R., with headquarters at Omaha, Neb., has been promoted to general superintendent of motive power and machinery of the Union Pacific system, a newly-created position, with headquarters at the same place. J. W. Burnett, formerly assistant superintendent of motive power and machinery now becomes superintendent. Both men have had wide railroad and shop experience.

RUSSELL W. PORTER, Jones & Lamson Machine Co., Springfield, Vt., has been called in as a consultant on the job of building the 200-in. reflecting telescope for the Mt. Wilson Observatory, California. The type of mounting adopted for the big tube is similar to the one described by Mr. Porter in the *Scientific American* some time ago. Several months after the publication of this article, a mounting very much like Mr. Porter's was described by Mr. Pease, the engineer of the Observatory. Mr. Porter's work will consist of advice on the layout of the shops and the methods to be employed in making the telescope.

Obituaries

RALPH H. BOURNE, who resigned as senior vice-president of the Whiting Corporation, Harvey, Ill., in 1927, died on Nov. 27 at Wareham, Mass. At one time he had been with the Wellman-Seaver-Morgan Co., Cleveland, and with the Hoover & Mason Co., Chicago. In 1907 he became associated with the Whiting Foundry Equipment Co., now the Whiting Corporation.

ARTHUR BERRY, for 20 years mechanical designer of the needle department of the New Home Sewing Machine Co., Orange, Mass., died Nov. 29, at a Boston hospital, where he had undergone a serious operation. He was 60 years old and a native of Springfield. His industrial life was spent with concerns in Athol and Orange. For four years he was manager of the Lee Shoe Co., and was factory manager of the Leavitt Machine Co., Orange, at the time of his death.

Forthcoming Meetings

Western Metal Congress and Western States Metal & Machinery Exposition. Held in Los Angeles, Jan. 14-18, under the auspices of the American Society for Steel Treating. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

American Society of Mechanical Engineers. Regional meeting in Knoxville, Tenn., March 21-22, 1929. W. R. Woolrich, professor of mechanical engineering, University of Tennessee, Knoxville, in charge of program.

American Society of Mechanical Engineers. Semi-annual meeting, July 1-4, 1929, in Salt Lake City, Utah. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

Demand for steel remains good with few price changes since last week. Principal requirements are for shipbuilding, pipe lines, car building. The increase in the amount of winter construction is an important factor in keeping the market active. The U. S. Steel Corporation is operating at a slightly smaller capacity than the independents' figure of 84 per cent compared with 82 per cent the week before.

(All prices as of Dec. 7, 1928)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$19.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	25.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	16.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	22.26
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.00@2.10	3.35	3.25	3.90*
No. 12	2.05@2.15	3.40	3.30	3.95*
No. 14	2.15@2.25	3.45	3.35	4.00*
No. 16	2.25@2.35	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.55@2.65	3.60	3.40	4.00
No. 22	2.70@2.80	3.75	3.55	4.15
No. 24	2.75@2.85	3.80	3.60	4.20
No. 26	2.85@2.95	3.90	3.70	4.30
No. 28	3.00@3.10	4.05	3.85	4.45
Galvanized				
No. 10	2.70@2.80	3.95	3.75	4.25
Nos. 12 to 14	2.80@2.90	4.05	3.85	4.35
No. 16	2.90@3.00	4.15	3.95	4.45
No. 18	3.05@3.15	4.30	4.10	4.60
No. 20	3.20@3.30	4.45	4.30	4.75
No. 22	3.25@3.35	4.50	4.35	4.80
No. 24	3.50@3.60	4.65	4.45	4.95
No. 26	3.65@3.75	4.90	4.70	5.20
No. 28	3.90@ .00	5.15	4.95	5.45

250 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness—Decimal	B.w.g. and Fractions	Outside Diameter in Inches—¼	⅜	½	⅝	¾	1	1¼	1½
		Price per Foot							
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23	
.049"	18	.17	.18	.19	.20	.21	.23	.25	
.065"	16	.19	.20	.21	.22	.23	.25	.27	
.083"	14	.20	.22	.23	.24	.25	.27	.29	
.095"	13	.21	.23	.25	.26	.27	.29	.31	
.109"	12	.22	.24	.26	.27	.28	.30	.32	
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33	
.134"	10	.24	.26	.28	.29	.30	.32	.34	

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25‡	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$@½-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, $\frac{3}{32}$, 8.35c.; $\frac{1}{8}$, 7.85c.; $\frac{5}{32}$ to $\frac{1}{4}$, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			16.75
Tin, Straits, pigs, New York			53.00
Lead, pigs, E. St. Louis	6.25	New York	7.75
Zinc, slabs, E. St. Louis	6.35	New York	7.75

	New York	Cleveland	Chicago
Antimony, slabs	13.50	14.00	14.25
Copper sheets, base	25.00	25.00	25.00
Copper wire, base	21.21⅜	21.25	17.87½*
Copper bars, base	23.50	23.50	24.00
Copper tubing, base	26.37½	26.37½	26.37½
Brass sheets, high, base	20.50	20.50	20.50
Brass tubing, high, base	25.37½	25.37½	25.37½
Brass rods, high, base	18.25	18.25	18.25
Brass wire, high, base	21.00	21.00	21.00

*At mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%	25.00*	24.30	24.30
Zinc sheets (casks)	10.00@10.50	11.00	10.11
Solder (½ and ½)	35.75	35.00	31@34
Babbitt metal, delivered in case lots, New York, cents per lb.:			
Genuine, highest grade			69.25
Commercial genuine, intermediate grade			53.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			12.25
Nickel, f.o.b. refinery, Bayonne, N. J., cents per lb.:			
Ingots 35.00	Electrolytic 37.00	Shot	36.00

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled nickel rods, Grade "A" (base)	45.00
Cold drawn nickel rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	28.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity:

	New York	Cleveland	Chicago
Crucible copper	14.00 @14.25	13.75	12.75@13.25
Copper, heavy, and wire	13.25 @14.00	13.00	12.12½@12.50
Copper, light, and bottoms	11.75 @12.25	11.00	11.00@11.50
Heavy lead	5.00 @ 5.25	6.25	4.75@ 5.25
Tea lead	3.37½@ 3.87½	4.25	3.75@ 4.25
Brass, heavy, yellow	7.75 @ 8.00	8.50	8.00@ 8.50
Brass, heavy, red	10.75 @11.25	....	10.25@10.75
Brass, light	6.25 @ 6.75	6.75	6.75@ 7.25
No. 1 yellow rod turnings	9.00 @ 9.50	9.50	8.75@ 9.25
Zinc	3.25 @ 3.50	3.25	3.00@ 3.50

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20	6.45	6.10	7.00
	Terne Plates—8-lb. Coating—Small lots—Per box			
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb	.16@.16½	38.00 per M	.17
Sal soda, per lb	.02	.02	.02
Roll sulphur, per lb	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb	.11	.11	.114
Cutting oil, about 25% lard, in 5 gal. cans, per gal	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal	.30	.36	.36
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply.:			
Medium grade	30–10%	30–10%	35%
Med. grade, heavy wgt.	30–5%	30–5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	50%	50–10%	50%
Second grade	60%	60–5%	50–10%

*All waste in bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0325	$0.0325	$0.0324
Cold drawn shafting	per lb.	.034	.034	.04
Brass rods	per lb.	.1825	.175	.16
Solder (½ and ½)	per lb.	.3575	.345(	.3575
Cotton waste, white	per lb.	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No 1, 6-in. dia	per 100	3.59	3.59	3.10
Lard cutting oil	per gal.	.65	.65	.65
Machine oil	per gal.	.30	.30	.27
Belting, leather, medium	off list	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper	$4.05	$4.29	$4.29
Emery cloth	20.22	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper	2.04	2.04	2.04
Cloth	3.59	3.59	3.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville,		2.85@3.00
Coke, prompt foundry, per net ton	Connellsville,		4.00@4.50
White lead, dry or in oil	100 lb. kegs	New York,	13.25
Red lead, dry	100 lb. kegs	New York,	13.25
Red lead, in oil	100 lb. kegs	New York,	14.75

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.	55%
Larger up to 1 x 30-in.	50%
1¼ and 1½ in. dia.	35%
Carriage bolts:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Coach and lag screws:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb	$3.50*
Rivets, button and cone head:	
Small, including ⅞-in. dia.	50–10%
Large (base) per 100 lb. net	$5.00†

Note—For less than full package quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.

*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Calif., San Francisco—Bureau of Supplies and Accounts, Navy Dept., Washington, D. C.—will receive bids until Dec. 18 for three hack saws one jig saw and one bench grinder, all motor driven, here.

Ill., Chicago—Western Electric Co., 504 South Clinton St.—one 10 ton overhead traveling crane.

Mich., Detroit—Federal Mogul Corp., 11031 Shoemaker Ave.—machine equipment for the manufacture of bearings for proposed 1 story, 120 x 180 ft. addition to factory. Estimated cost $53,000.

Mich., Detroit—Huron Forge & Machine Co., 9041 Alpine St.—machine shop equipment for plant expansion.

Mich., Detroit—Michigan Smelting & Refining Co.—machine equipment for finishing small castings for proposed 1 story, 60 x 200 ft. brass work factory. Estimated cost $50,000.

Mich., Detroit—Murray Corp. of America, 1975 Clay Ave.—(automobile body manufacturers)—five open side planers, 2 large, 2 medium and one small size.

Mich., Detroit — Reliable Scrap Iron & Metal Co., 2110 Franklin St.—large shear for cutting scrap.

Mich., Detroit—Star Tool & Die Works, 2520 24th St.—machine shop equipment for plant expansion.

Mich., Wayne—Stinson Aircraft Corp.—Northville—equipment for the manufacture of complete airplanes for proposed 1 and 2 story, 200 x 400 ft. factory. Estimated cost $250,000.

Mo., St. Louis—Wagner Electric Co., 6400 Plymouth St.—one 30 ton, one 5 ton and one 2 ton traveling cranes for proposed factory. Estimated cost $1,000,000.

Pa., Ambridge — Spang Chalfant Co., Etna, J. A. Herman, Purch. Agt.—one 15 ton, one 5 ton, four 6 ton and three 6 ton overhead electric cranes for proposed 1 story, 240 x 800 ft. addition to plant. Est. cost $250,000.

Pa., Huntingdon—E. H. Lorenz Machine Works—milling machine, 20 or 24 in. crank shaper and punch and shear.

Opportunities for Future Business

Ala., Birmingham—Lamson & Sessions Co., 2188 Scranton Rd., Cleveland, O., will build a plant for the manufacture of bolts, nuts, rivets and cotter pins here. Estimated cost $500,000 to $700,000.

Ark., Pine Bluff—Seaman-Dunning Corp., awarded contract for the construction of a 1 story, 218 x 280 ft. addition to auto body plant.

Conn., Bridgeport—Bridgeport Brass Co., W. R. Webster, East Main St., plans the construction of a new brass rolling mill unit. Estimated cost $40,000. Architect not selected.

Conn., Bridgeport—Crane Co., J. H. Collier, Mgr., manufacturers of boilers, radiators, etc., plans the construction of a 1 story, 125 x 500 ft. factory. Estimated cost to exceed $150,000. Private plans.

Conn., Danbury — Anderson Nash Corp., 143 White St., will soon award contract for the construction of a 1 story, 70 x 120 ft. repair and service garage at 82 West St. Estimated cost $40,000.

Conn., Hartford—A. C. Hine Co., 189 Washington St., awarded contract for a 1 story, 65 x 200 ft. sales and service station on Washington St. Estimated cost $55,000.

Conn., Hartford — Metropolitan Corp., F. W. Arnold, Pres., 64 Pearl St., will build a 3 story, 70 x 140 ft. garage on Ann St. Estimated cost $135,000. Berenson & Moses, 252 Asylum St., Archts.

Conn., New London—A. B. Neimon, 36 Cleveland St., will soon award contract for a 1 story, 75 x 125 ft. garage on May St. Estimated cost $45,000. F. DeGange, 60 Ocean Ave., Archt.

Conn., New London—M. Rich & C. Rubin, c/o F. DeGange, 60 Ocean Ave., Archt., will build a 2 story, 50 x 100 ft. addition to factory and garage on Hamilton St.

Conn., Norwalk — W. R. Austin, Washington St. S., will soon award contract for a 1 story, 60 x 250 ft. sales and service station on West Ave. Estimated cost $125,000. Fletcher-Thompson Inc., 542 Fairfield Ave., Bridgeport, Archt. Noted Nov. 1.

Conn., Stamford—Redman Chrevolet Co., Mill River St., awarded contract for the construction of a 2 story, 50 x 100 ft. garage. Estimated cost $50,000.

Conn., Stamford—Southern New England Telephone Co., 157 Church St., New Haven, awarded contract for the construction of a 1 story, 87 x 162 ft. garage and repair shop on Jefferson St. Estimated cost $60,000.

Conn., Stratford — Sikorsky Aircraft Corp., Garden City, Long Island, N. Y., awarded contract for the construction of a factory for the manufacture of airplanes on Lordship St. Estimated cost $400,000.

Ill., Chicago — American Skylight Co., 2625 Fletcher St., manufacturers of sheet iron products, awarded contract for a 1 and 2 story, 75 x 100 ft. factory. Estimated cost $25,000.

Ill., Chicago—Illinois Tool Works, 2501 Keeler Ave., awarded contract for a 1 story, 120 x 120 ft. addition to factory at 2505-23 Karlov Ave. N. Estimated cost $40,000.

Ill., Chicago—S. B. Harrison, 5701 Broadway Ave., awarded contract for a 2 story, 78 x 108 ft. sales and service station at 6100-08 Western Ave., N. Estimated cost $75,000.

Ill., Mount Vernon — J. P. Devine Co., 1372 Clinton St., Buffalo, N. Y., will build a factory including machine shop, etc. here. Estimated cost $600,000. Noted Nov. 22.

Ia., Davenport — Blackhawk Machine & Foundry Co., W. K. Voss, Pres., 223 Clark St., plans a 1 story addition to foundry. Private plans.

Ia., Sioux City—Benson Furniture Co., 1911 East 4th St., awarded contract for a 5 story, 40 x 80 ft. furniture factory. Estimated cost $40,000.

Me., Biddeford—W. F. Mahoney, 62 Alfred St., is receiving bids for a 1 story, 60 x 150 ft. repair and service garage at Elm and River Sts. Estimated cost $60,000. A. R. Farington, 178 Dartmouth St., Portland, Me., archt.

Md., Baltimore—Bureau of Street Cleaning, City Hall, will build addition to automobile repair shop and garage at 1139 to 1149 Granby St.

Mass., Fall River — Borden-Remington Co., 115 Anawam St., is having revised plans prepared for a 1 story, 75 x 100 ft. repair and service garage on Pleasant St. Estimated cost $45,000. E. M. Corbett, 167 Bedford St., Archt. Former bids rejected. Noted Mar. 29.

Mass., Leominster — J. G. Peterson, 23 Hale St., awarded contract for a 1 story repair and service garage at 162 Main St. Estimated cost $40,000 to $50,000. Noted Nov. 1.

Mass., Leominster — G. H. Radford, c/o H. L. Meachem, 120 Front St., Worcester, Archt., is receiving bids for 1 story repair and service garage at 650 North Main St. Estimated cost $40,000.

Mass., Lynn — Gallant Motor Co., 319 Essex St., awarded contract for a 1 story, 45 x 105 ft. repair and service garage on Essex St. Estimated cost $50,000. Noted Nov. 15.

Mass., Medford (Boston P.O.)—Noyes-Buick Sales Co., 857 Commonwealth Ave., Boston, will build a 1 story, repair and service garage on Swan St. Estimated cost $50,000. Private plans.

Mass., New Bedford — A. Bellotti, 682 Acushnet Ave., will build a 1 story aeroplane repair shop, also addition to garage. Private plans.

Mass., North Weymouth (br. Boston)—Standard Oil Co. of New York, Park Sq. Bldg., Boston, will build a 60 x 100 ft. garage, etc. here. Private plans.

Mass., Reading—M. E. Brande, 103 Woburn St., plans the construction of a 1 story repair and service garage on Main St. Estimated cost $40,000. Private plans.

Mass., Roxbury (Boston P. O.)—Boston Elevated Railway Co., 31 St. James Ave., Boston, is receiving bids for the construction of a garage and repair shop, etc., here. Estimated cost $75,000 to $100,000. A. J. Blackburn, 31 St. James Ave., Boston, Co. Archt.

Mass., Roxbury (Boston P.C.)—J. F. Morse & Co., 66 Norfolk St., awarded contract for a 2 story repair and service garage at 62-66 Norfolk St. Estimated cost $50,000.

Mass., Somerville (Boston P.O.)—E. M. Cremen, 10 Union Sq., will build a garage on Central St. Estimated cost $40,000. Architect not selected.

Mich., Detroit—City is having plans prepared for the construction of a 1 and 2 story aircraft exhibition building at French and Lynch Rds. Estimated cost $1,000,000. P. A. Fellows, City Hall, Engr.

Mich., Detroit—Zenith Detroit Corp., Hart Ave., awarded contract for a 2 story, 68 x 118 ft. carburetor factory on Lycast Ave. Estimated cost $50,000.

Minn., Minneapolis—Minneapolis Waterworks Dept., J. A. Jensen, Supvr., 219 City Hall, will soon award contract for a 1 story shop at Longellow Ave. and East 26th St. Estimated cost $35,000.

Minn., Minneapolis — Northwest Terminal Co., W. L. Badger, Pres., East Hennepin Ave. and Stinson Blvd., will soon award contract for a 1 story, 65 x 144 ft. repair and service garage at Roosevelt and Kennedy Sts. N. W. Estimated cost $40,000. Ekman, Holm & Co., 601 Phoenix Bldg., Archts.

Minn., St. Paul—Ten Minute Auto Washing Corp., W. P. Driscoll, Pres., 258 West University Ave., will soon receive bids for a 1 story, 120 x 120 ft. garage at University and Syndicate Aves. Estimated cost $40,000. Tolt, King & Day, Inc., Builders Exchange Bldg., Archts.

Neb., Lincoln—C. C. Kimball, 2600 Rathbone Rd., awarded contract for a 1 story, 100 x 142 ft. sales and service garage at 18th Ave. and P. St. Estimated cost $40,000.

Neb., Omaha — Charles W. Rosenberry, 350 Brandeis Theatre Bldg., awarded contract for a 3 story, 66 x 142 ft. garage at 17th and Dodge Sts. Estimated cost $50,000. Owner's name withheld.

N. H., Manchester—Perreault & Labonte, Elm St., will build a 2 story repair and service garage. Estimated cost $40,000.

N. J., Elizabeth—American Gas Accumulator Co., Newark Ave., awarded contract for a 1 story, 60 x 140 ft. addition to factory. Estimated cost $40,000.

N. J., Hackensack—Owner, c/o J. L. Theodore Tillack, 173 Main St., Archt., is having sketches made for the construction of a 2 story garage at Union St. and Gamewell Ave. Estimated cost $150,000.

N. J., Hackensack—T. Walker, Closter, awarded contract for a 2 story, 115 x 140 ft. garage at First St. and Atlantic Ave. Estimated cost $150,000.

N. J., Kearny—Western Electric Co., 195 Broadway, New York, N. Y., had plans prepared for the construction of a 6 story factory here. Estimated cost $150,000.

N. J., Newark—New Jersey Bell Telephone Co., 1060 Broad St., awarded contract for the construction of a 2 story garage. Estimated cost $150,000. Noted Nov. 1.

N. J., Newark—Owner, c/o F. Koenigsberger, 48 Walnut St., Archt., will soon award contract for a 3 story, 50 x 200 ft. garage. Estimated cost $100,000.

N. J., Newark—J. Weisberger, 55 Shanley Ave., will build a 2 story, 100 x 150 ft. garage at 233-47 Park Ave. Estimated cost $150,000. Private plans.

N. J., Paterson—Letz & Katz, 617 Broadway, is having plans prepared for a 1 story, 100 x 400 ft. service station at 35th and Market Sts. Estimated cost $150,000. Coleman & Haloran (Dodge Agency), c/o owner, lessee.

N. J., Radburn—Central Supply Co., 255 Pearl St., New York, N. Y., manufacturers of plumbing and heating equipment, plans the construction of a 1 story factory, here. Estimated cost $40,000. Architect not announced.

N. Y., Brooklyn — Bartholdi Turecano, Denyses Lane, plans the construction of a 2 story, 40 x 122 ft. garage at 88th St. and East 4th Ave. Estimated cost $60,000. F. Savignano, 6005 14th Ave., Archt.

N. Y., Brooklyn—E. Bender, will soon award contract for the construction of a garage at East New York and St. Marks Aves. Estimated cost $40,000. C. Goodman, Archt.

N. Y., Brooklyn — M. Bergrenn, 552 Ovington Ave., plans the construction of a 2 story, 80 x 81 ft. garage at 64th St. and 7th Ave. Estimated cost $40,000. W. E. Martin, 9401 5th Ave., Archt.

N. Y., Brooklyn—Buchwick Can Co., 86 Butter St., will build a factory at Henry and West 9th Sts. Estimated cost $40,000. W. A. Lacerenza, 26 Court St., Archt.

N. Y., Brooklyn—Chyskin Bros., 804 Park Ave., will soon award contract for the construction of a garage at Park and Throop Aves. Estimated cost $40,000. W. E. Doyle, Archt.

N. Y., Brooklyn—Corp., c/o M. Berman, 590 Utica Ave., plans the construction of a 1 story, 100 x 164 ft. garage at Gravesend Ave. and Kingshighway. Estimated cost $40,000. M. Rothstein, 186 Joralemon St., Archt.

N. Y., Brooklyn—Corp., c/o S. Katz, 550 Bristol St., plans the construction of a 1 story, 100 x 114 ft. garage at Dean St. and Rochester Ave. Estimated cost $50,000. Cohn Bros., 361 Stone Ave., Archt.

N. Y., Brooklyn—Corp., c/o J. S. Ramke, 1710 Ocean Ave., awarded contract for the construction of a garage at Meeker and Vanderwoort Aves. Estimated cost $40,000.

N. Y., Brooklyn—B. Lewittes, 8908 Northern Blvd., Jamaica, plans the construction of a 2 story, 82 x 237 ft. garage at West 35th St. and Surf Ave. Estimated cost $100,000. M. Schantz, 25 Spruce St., New York, Archt.

N. Y., Brooklyn—S. Manlay, c/o N. Klein, 65 Court St., Archt., plans the construction of a 1 story, 100 x 160 ft. garage at Middleton St. and Marcy Ave. Estimated cost $50,000.

N. Y., Brooklyn—J. M. Maran, 119-11 196th St., St. Albans, plans the construction of a 1 story, 90 x 100 ft. garage at Gates and Bushwick Aves. Estimated cost $40,000. H. M. Sushan, 367 Fulton St., Archt.

N. Y., Brooklyn—National Lead Co., E. J. Carnish, Pres., 111 Broadway, New York, will soon awarded contract for the construction of a 122 x 172 ft. factory at Marshall and Gold Sts. Estimated cost $225,000. W. Higginson, 101 Park Ave., Archt. Noted Nov. 8.

N. Y., Brooklyn—Ryan Bros. Inc., 17th St. and 3rd Ave., plans the construction of a 2 story, 80 x 120 ft. garage. Estimated cost $75,000. Slel & Bryson, 160 Montague St., Archts.

N. Y., Brooklyn—P. Schwartz, Manhattan Ave. and Richardson St., plans the construction of an 80 x 125 ft. garage. Estimated cost $40,000. C. M. Spindler, 104 Montague St., Archt.

N. Y., Jackson Heights (sta. Flushing)—D. Druss, 3737 Warren St., Elmhurst, will soon award contract for the construction of a garage at 34th Ave. and 70th St. H. Dort, is Archt.

N. Y., Manhassett—Borden Farms Inc., 110 Hudson St., New York, awarded contract for a 1 and 2 story garage, shop, etc. at Myrtle St. and Hillside Ave. here. Estimated cost $75,000.

N. Y., New York—M. Allen, 1122 Anderson Ave., plans the construction of a 1 story, 50 x 184 ft. garage at 167th St. and Ogden Ave. Estimated cost $40,000. W. F. Doyle, 11 John St., Archt.

N. Y., New York—Corp., c/o M. Breneastock, 463 7th Ave., plans the construction of a 2 and 3 story, 100 x 253 ft. garage at Bronxdale Ave. Estimated cost $250,000. Shampan & Shampan, 188 Montague St., Brooklyn, Archts.

N. Y., New York—Frank De Marco Inc., 1212 University Ave., is receiving bids for the construction of a garage at River Ave. and 157th St. W. Shary, 41 Union Sq., Archt.

N. Y., New York—R. Hingers, 3350 Fenton Ave., plans the construction of a 2 story, 85 x 106 ft. garage at Jerome Ave. and 198th St. Estimated cost $200,000. J. C. Watson, 271 West 125th St., Archt.

N. Y., New York—Jonell Realty Co. Inc., J. J. Gilhuly, c/o J. P. Boyland, 305 East Kingsbridge Rd., Archt., plans the construction of a garage at 204th St. and Webster Ave. Estimated cost $40,000.

N. Y., New York—Laura Realty Corp. Inc., D. Snow, Pres., 200 West 72nd St., plans the construction of a 5 story, 75 x 194 ft. garage at 524 East 73rd St. Estimated cost $150,000. W. E. Somerfeld, 31 Union Sq., Archt.

N. Y., New York—Nicholas & Caterina Seiscente, 305 East Kingsbridge Rd., plan the construction of a 2 story, 75 x 176 ft. garage at Webster Ave. and 204th St. Estimated cost $40,000. J. P. Boyland, 305 East Kingsbridge Rd., Archt.

N. Y., New York—Gerosa Paladino Holding Corp., 286 East 137th St., plans the construction of a 1 story, 100 x 295 ft. garage at Austin Pl. and East 149th St. Estimated cost $75,000. De Rose & Cavalieri, 370 East 149th St., Archts.

N. Y., New York—Dwight P. Robinson Co. Inc., 125 East 46th St., will build a 9 story, 125 x 200 ft. garage at 205 East 64th St. Estimated cost $500,000. Private plans. Noted Nov. 8.

N. Y., New York—Schact Holding Corp., 54 West 174th St., plans the construction of a 100 x 100 ft. garage at White Plains Ave. and Britton St. Estimated cost $45,000. Bluck & Duma, 400 East Fordham Rd., Archts.

N. Y., New York—Wandsworth Corp., A. Pearse, Pres., 2804 3rd Ave., is receiving bids for the construction of a garage at Mott Ave. and 156th St. Estimated cost $600,000. M. Klein, 65 Court St., Brooklyn Archt.

N. Y., New York—Waring Plains Corp., C. Klapon, Pres., 505 East Tremont Ave., will soon award contract for the construction of a 95 x 200 ft. garage at Buhre Ave. and Appleton St. Estimated cost $40,000. C. S. Clark, 441 East Tremont Ave., Archt.

N. Y., New York—West Farms & Boone Ave. Corp., R. Grutman, Pres., 1391 Nelson Ave., will soon award contract for the construction of a garage at Boone Ave. and 176th St. L. Stillman, 199 South Jerome Ave., Archt.

N. Y., St. George (sta. Staten Island)—St. George Gardens Inc., 26 Court St., Brooklyn, will soon award contract for the construction of garage at Henry and Cleveland Sts. here. Estimated cost $40,000. S. Gardstein, 44 Court St., Brooklyn, Archt.

N. Y., White Plains — A. W. Page, 76 South Lexington Ave., awarded contract for a 2 story garage at Fisher and Lexington Ave. Estimated cost $80,000.

O., Cleveland—Cleveland Knife & Forge Co., 1960 West 114th St., awarded contract for a 1 story, 28 x 126 ft. addition to factory. Estimated cost $40,000.

O., Cleveland—Eaton Axle & Spring Co., C. J. Ochs, Pres., East 65th St. and Central Ave., had plans prepared for the construction of a 1 story, 51 x 130 ft. factory at East 69th St. and Central Ave. Estimated cost $40,000. G. S. Rider Co., Century Bldg., Archt.

O., Cleveland—Gluntz Brass Foundry Co., D. J. Gluntz, Pres., 3001 East 55th St., plans the construction of a machine shop at Mites Ave. and East 108th St. Estimated cost $40,000. J. H. O'Grady, 2251 Goodnor Rd., Archt.

O., Cleveland—Huron Fireproof Building Co., c/o A. Sogg, 3030 Euclid Ave., Archt., will soon award contract for a 3 story, 80 x 128 ft. garage on Huron Rd. Estimated cost $150,000.

O., Cleveland—Jordon Motor Co., E. S. Jordon, Pres., 1070 East 152nd St., awarded contract for a 1 story, 40 x 100 ft. factory to replace fire loss at 1070 East 152nd St. Estimated cost $40,000.

O., Cleveland—T. Sluzynski, 6886 Broadway, awarded contract for a 1 story, 20 x 90 ft. automobile body shop. Estimated cost $40,000.

O., Cleveland—Superior Holding Co., c/o L. Krueger, Pres. and Treas., Fidelity Bldg., awarded contract for a 2 story, 65 x 150 ft. garage at 1291 East 101st St. Estimated cost $150,000. Young Furniture Co., 10403 Superior Ave., lessee.

O., Cleveland—Ulchek Tool Co., F. J. Vlchek, Pres., 3001 East 87th St., awarded contract for a 1 story, 40 x 125 ft., forge shop. Estimated cost $40,000.

O., Elyria—Cleveland Automatic Machine Co., 2269 East 65th St., Cleveland, is having plans prepared for addition to plant, here. Estimated cost $250,000. Private plans. Noted Nov. 29.

Pa., Ambridge—A. M. Byers Co., Clark Bldg., Pittsburgh, is having preliminary surveys made for the construction of a pipe plant here. Estimated cost $20,000,000. H. A. Brassert & Co., 310 South Michigan Ave., Chicago, Ill., Engrs.

Pa., McKees Rocks—Pressed Steel Farmers Bank Bldg., Pittsburgh, awarded contract for a 1 story, here. Estimated cost $40,000.

Pa., Pittsburgh—Davidson Coke & Iron Co., Oliver Bldg., c/o G. S. Davison, Pres., Gulf Refining Co., awarded contract for the construction of a pig iron and cement plant on Neville Island. Estimated cost $1,500,000.

R. I., Pawtucket—Balkcom-Brooks Co., 144 East Ave., will soon award contract for the construction of a 2 and 3 story repair and service garage on East Ave. Estimated cost 50,000. Private plans.

R. I., Providence—Colt, Birmingham & Brady Inc., 1 Reservoir Ave., awarded contract for a 1 story addition to repair and service garage. Noted Nov. 15.

R. I., Providence—Dept. of Public Buildings, City Hall, will soon award contract for a 1, 2 and 7 story, 85 x 200 and 20 x 20 ft. repair shop, etc. at Dexter and Whitmarsh Sts. Estimated cost $65,000. T. J. H. Pierce, City Hall, Engr.

R. I., Providence—C. H. Lockwood, 171 Westminster St., Archt., is preparing preliminary plans for a 2 story jewelry factory. Estimated cost $50,000. Owner's name withheld .

S. D., Sioux Falls — Chevrolet Sales & Service Garage, will soon awarded contract for a 1 story, 88 x 140 ft. repair and service garage at 11th Ave. and Main St. S. Estimated cost $50,000. Hughill & Blatherwick, 367 Boyce-Greeley Bldg., Archts.

Tex., Mission—Snydor Motor Co. plans the construction of a 1 story, 100 x 100 ft. sales and service station. Estimated cost $45,000. Architect not selected.

Vt., Barre—H. F. Farnham & Sons, 50 Court St., Montpelier, awarded contract for a 1 story garage and repair shop at 330 North Main St., here.

West Virginia—Chesapeake & Ohio Ry. Co., Richmond, plans to expend $10,800,000 for extensions and improvements to lines including machine and locomotive repair shops at Huntington, also new car repair shops at Russell. C. W. Johns, Ch. Engr.

Wis., Manitowoc—National Tinsel Mfg. Co., 16th and Hamilton Sts., awarded contract for a 3 story, 52 x 150 ft. addition to factory.

Ont., Toronto—Massey-Harris Co. Ltd., King St. W., awarded contract for the construction of a 40 x 280 ft. factory for the manufacture of agricultural machinery. Estimated cost $100,000.

Wis., Milwaukee — S. B. White, c/o G. Schley & Sons, 425 East Water St., Archts., plans the construction of a 2 story, 150 x 240 ft. garage on Michigan St.

Ont., Toronto—Puddicombe Motors, Ltd., 1543 Bloor St. W., plans the construction of a 4 story garage. Estimated cost $200,000. Architect and engineer not announced.

Ont., Toronto—W. C. Warburton & Co., 670 Bloor St. W., plans a 2 or 3 story addition to garage on Bloor St. Estimated cost $150,000. Architect and Engineer not selected.

Ont., Weston—Arco Co. Ltd., 16 Liberty St., Toronto, awarded contract for a 4 story, 50 x 70 ft. factory. Estimated cost $150,000.

Ont., Windsor—Auto Specialties Mfg. Co. of Canada, awarded general contract for addition to auto specialty plant. Estimated cost $75,000.

Ont., York—Riley Engineering & Supply Co., 360 Dufferin St., Toronto, will build a 1 story, 32 x 65 and 92 x 175 ft. factory for the manufacture of power house supplies herd. Estimated cost $100,000. H. G. Duerr, Lumsden Bldg., Toronto, Archts. Noted Nov. 29.

"Let's Start Asking Why"—The Super

"During the Collier radio hour, last Sunday, I heard the description of a unique invention. It was designed to change the water in gold-fish bowls. The inventor had assembled a sponge, a cat, a cuckoo clock, a water faucet and a brick to perform the work. Action started with the cat, involved the brick's fall into the bowl, the sponge absorbing the water splashed out and, by becoming heavier in the process, turning on the faucet to supply fresh water."

"Getting doty in your old age, Hawkins? We have more serious things than that to carry from back as far as last Sunday."

"Not so doty as you might think, Kennedy. My eight-year-old also heard the invention described and gave me something serious to think about. He asked why the sponge was not dipped in instead of dragging the brick and perhaps smashing the fish or the bowl."

"What's that to do with us?"

"Just this, Kennedy! I'm wondering why we put certain work through our milling machines. Or, to put it another way I am wondering what other work should be on the mills or the lathes or the shapers that is not there now.

"I'm wondering why we should make our good machines better as a chain manufacturer advertises in this issue. I'm asking why we are using the style of inserted tooth in our circular saws, that this saw maker says is old, when we might be getting much lower costs from the new style he illustrates in his ad.

"I'm asking myself how much guess work stands back of the material and parts specifications sent out from your engineering department and how much is backed by actual fact.

"We're taking too many things for granted, Kennedy! We're twisting too many jobs out of profitable channels to fit our present production equipment! Perhaps we need more shapers. Perhaps we don't need the ones we have. How do we know for certain?"

"Right there, Hawkins, you have said a mouthful. In part we can show reason for the way we do things and for the specifications we send through. But also there is more guesswork than should exist. Likewise we have equipment in service for whose existence we have no reasons at all.

"Take our plating generator for example. If you were a little generator yourself this one could be your grandfather. Why is it there at work, Hawkins? Simply because it will still generate and because it can't talk loud enough to tell you how old and feeble and all tired out it really is, and how much we'd be ahead with the up-to-date one shown in these ads.

"You get what I'm driving at, Kennedy. Let's look for the places where there is no reason behind our practice and find the reason or change the practice. Let's start asking why to these many things we do!"